MARCH, 1952

PRICE, $1.00

PUBLIC LIBRARY
DETROIT

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

The Shop Teachers' Professional Magazine

SCHOOL SHOP ANNUAL

U. S. Forest Service Photo

For the needs of the nation

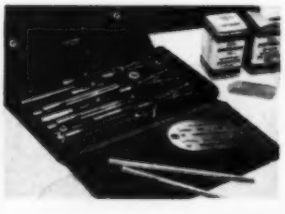
The needs of the nation are for great quantities of lumber. Our forests are being used up faster than they naturally grow. So, the U. S. Forest Service Institute of Forest Genetics out in California is working to produce new varieties of pine, for example, that grow faster, to bigger sizes, and are more immune to disease and drought. How is this being done? By cross breeding, by dusting the conelets of one tree with the pollen from another tree possessing the desired characteristics.

The needs of the nation and the world are for a new growth of men from the youth of our classrooms who someday will have much to say about what happens to them, about them, and to others. What *does* happen *then* will depend on what the educator has done *today*. Has he fertilized their minds with inspiring ideas? Have the seeds of discrimination been sown? Will these boys know the need for the vigilance that protects their liberty yet refuse to let down the bars to license? Will they yield the right and fact of self-direction to their appetites, to other men and agencies . . . or hug them to their hearts? Will they fall prey to the cheap, the snide, the dishonest . . . or be revolted by it?

Neither men nor characters spring full grown from the ear of Jove. The claims and values of the spirit, the will to remain steadfast and to achieve, and the great imagination can be discovered and developed in the classroom. Careers and characters and destinies always start with the near, small, familiar. The way *these* point is the way career or character or destiny will ride. Shall a youngster be *introduced* to mechanical drafting and to his future with cheaply made, carelessly chosen drafting instruments and supplies? Or shall these tools so closely associated with the work, by virtue of their high craftsmanship and quality help to set the direction for all the rest that follows? The answer to this question should not be dictated by an "economy" of a few pennies but by a realistic consideration of the tremendous values at stake.

EUGENE DIETZGEN CO.

Chicago · New York · San Francisco · New Orleans · Los Angeles
Pittsburgh · Washington · Philadelphia · Milwaukee
Dealers in All Principal Cities



DIETZGEN

EVERYTHING FOR DRAFTING
SURVEYING AND PRINT-MAKING

Metalworking
for all your school shop needs

Basal Texts

AIR CONDITIONING METAL LAYOUT
Kaberlein
Complete text in sheet metal duct work which uses square, rectangular, circular, and transition fittings. $3.75

SHORT CUTS FOR ROUND LAYOUTS
Kaberlein
Laying out and forming patterns for round elbows, angles, T's, offsets, tapers, cones, branches, cyclones. $3.75

TRIANGULATION SHORT-CUT LAYOUTS
Kaberlein
Shortest forms for laying out and forming patterns for blower exhaust systems, heating, and air conditioning. $5.00

COURSE IN SHEET METAL WORK
Bollinger
An illustrated beginner's text explaining fundamental operations and tools in sixty interesting projects. $1.40

ARTISTIC METALWORK
Bick
A wide range of projects that are both artistic and inexpensive to make. $3.75

METALWORK ESSENTIALS
Tustison and Kranzusch
Adaptable to the simply equipped shop are these 33 units containing basic information in characteristic bench processes. $2.50

ELEMENTS OF SHEET METAL WORK
Welch
A complete course in elementary sheet-metal work without involved technical descriptions. $1.96

Announcing —

ARC WELDING
Charles H. Zielke

This new basic text covers both general information on welding and its tools and terms, and job lessons ranging from basic techniques to advanced welding of difficult joints and metals. Each lesson includes questions. 80 cents

50 METAL-SPINNING PROJECTS
Reagan and Smith
Modernistic patterns in projects of varied appeal, from lamps to camping utensils. $2.00

METAL SPINNING
Reagan and Smith
Complete, detailed instructions on this craft. $1.75

ELEMENTARY AND APPLIED WELDING
Groneman and Rigsby
A beginning welding project book with oxyacetylene and electric arc welding techniques thoroughly described and illustrated. Arranged in order of difficulty. $2.00

PIPE FITTER'S AND PIPE WELDER'S HANDBOOK
Frankland
Pocket-sized reference manual with basic trade math, calculations, and reference material. $1.25

HAND-WROUGHT IRONWORK
Krom and Paige
Fifty projects within the range of elementary and high school students — lamps, wall brackets, doorknockers, etc. $2.75

ELEMENTARY WROUGHT IRON
Bollinger
Explaining properties and operations of iron and steel, with 68 carefully graded projects for junior high. $2.00

METALWORKING MADE EASY
Becker
Simple projects, illustrated, arranged according to difficulty. $2.00

WORKING WITH ALUMINUM
Hobbs
Twenty-five useful projects. Illustrated. $2.50

Project Books

INDIAN SILVERSMITHING
Ben Hunt
Coming soon, this newest "Ben Hunt" book covers the Indian silversmithing craft competently. Illustrated descriptions of tools and equipment and how to make them with explanation of silver soldering, finishing, setting stones and making bezels. Forty-three full-page plates of projects including ear ornaments, bracelets, rings, belt buckles, beads, necklaces, neckerchief slides and many others.

ORNAMENTAL TIN CRAFT
Groneman
Sturdy,, attractive articles to make of heavier material in 35 projects produced by sweating together pieces of sheet metal salvaged from tin cans. $3.00

SIMPLE BRACELETS
Bollinger
Many kinds of metal are used in these 154 designs of professional-looking, easy-to-make bracelets. $2.50

32 METAL SPINNING DESIGNS
Johnson
Complete instructions for beginner and more advanced craftsman. $1.75

INTERESTING ART-METAL WORK
Lukowitz
Use only simplest tools and processes for these 30 useful, artistic articles to make in a few hours each.
Cloth, $2.00; paper, 50 cents

101 METAL-WORKING PROJECTS
Petersen
Complete directions with working drawings. $2.75

55 NEW TIN-CAN PROJECTS
Petersen
Discarded tin cans can be made into beautiful and useful objects by following these instructions. $1.50

Examination copies sent for 30 days' study — no obligation.

The Bruce Publishing Company

703 Bruce Building **Milwaukee 1, Wisconsin**

Turning Terminology

(as visualized by Tom the Trainee)

"CHALKING THE HIGH SPOT"

Tom's real climb is to peak output as he learns on a sturdy, precision LeBlond Regal. And you'll chalk up a safety record that's really tops with rugged, dependable Regals in your shop. For this low-cost lathe with big-lathe features makes shop training easy and safe — helps prepare your boys for good jobs in industry.

Regal Lathes are backed by 64 years of machine tool experience, combined with the facilities of a plant turning out a complete line of 76 lathe models. Regal lathes are built in 13", 15", 17", 19", 21" and 24" sizes and in a 13" bench model. Write today for more information.

Geared headstock—Power is transmitted efficiently at eight conveniently selected speeds.

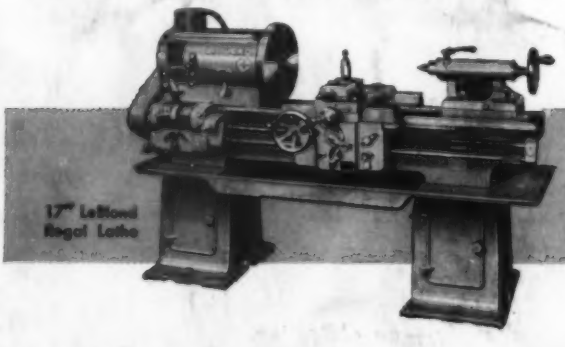
Quick-change box—56 feeds and threads can be chosen simply through this foolproof mechanism.

Leadscrew and feed rod—*Both* are provided to give you accurate thread-chasing, dependable feeds.

American Standard taper spindle nose—For safe, rugged, accurate positioning of chucks and faceplates.

One-piece apron—Long-life, sturdiness and protection from dirt are built into the double-wall apron.

THE R. K. LeBLOND MACHINE TOOL CO.
CINCINNATI 8, OHIO

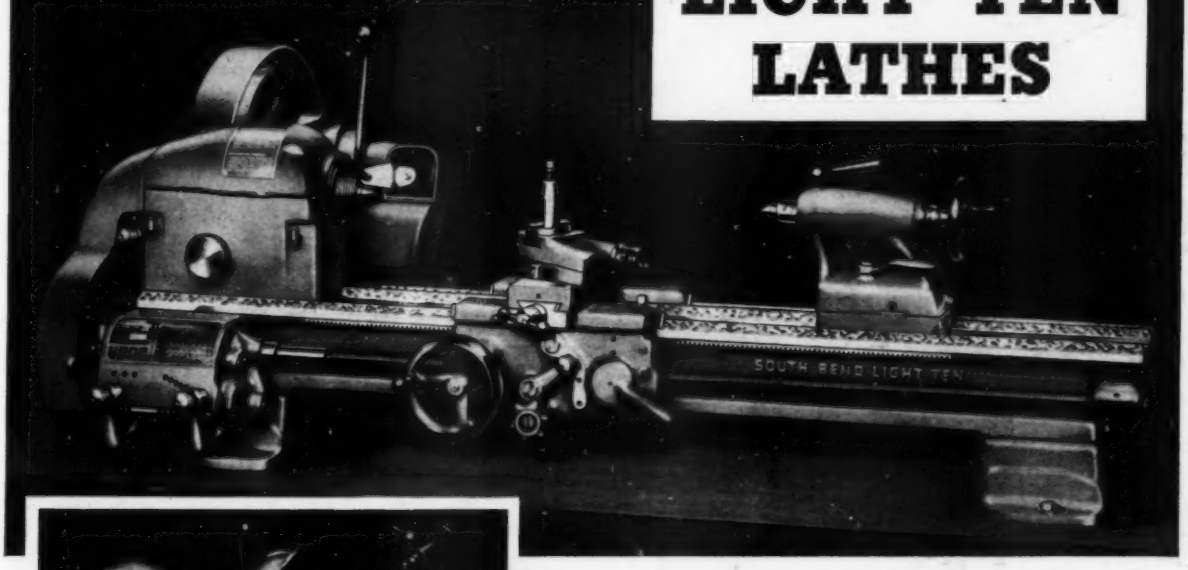


LeBLOND of Cincinnati

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES

Easy to Operate • Large-Lathe Features
Low Maintenance • Budget-Stretching Prices

South Bend LIGHT TEN LATHES



Light Ten Model A Bench Lathe—10" x 3-1/2'

Gears and pulleys well guarded, easily accessible

The new Light Ten Lathes are particularly suited for school shops. Dollar-for-dollar they are exceptional values. You get all the essential big-lathe features . . . full-range gear box, power feed apron, headstock with precision-bored bearings and super-finished spindle, 12-speed drive, rugged construction, skilled workmanship and dependable accuracy. Students learn quicker on South Bend Lathes for they are easy to operate and almost boy proof — power feeds cannot be locked and substantial guards enclose all gears and pulleys.

Built in seven models and four bed lengths. Full selection of attachments available. Send for complete information.

Light Ten Toolroom Lathe — 7" x 3-1/2'

New Lathe Handbook for Students

Every student should have a copy of the new 50th edition "How To Run a Lathe." Its 128 pages and more than 365 illustrations plainly describe in simple language all the fundamentals of engine lathe operation. Price 25c. Write for quantity prices and free sample copy (shop instructors and directors, only).

SOUTH BEND LATHE

SOUTH BEND 22, INDIANA

Building Better Tools Since 1906

Send Information Checked:

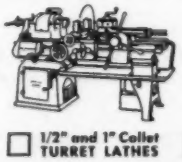
☐ LIGHT TEN LATHES

☐ LATHE ATTACHMENTS

☐ TEACHING HELPS Books and Films

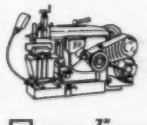
☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES



☐ 1/2" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES



☐ 7" BENCH SHAPERS

Name _____ School _____

Street _____ City & State _____

• A typical Nicholson file tooth shape in greatly exaggerated size. Mottled area is a photomicrographed cross section of file after hardening. The uniformly distributed white iron carbides are of extreme hardness.
1
FINE-PARTICLE IRON CARBIDES
2
EXCEPTIONAL HARDNESS
3
LONG-LASTING SHARPNESS
A good tip to remember
NICHOLSON U.S.A.

In a file, it's the tip of the tooth that counts. That's the part which does the work. On it depend the file's cutting efficiency and serviceable life. Nicholson metallurgy, tooth designing, cutting machinery, hardening processes—all combine to put onto Nicholson and Black Diamond file teeth the strongest, sharpest, longest-lasting tips science and human skill can achieve.

That's why the tips of the teeth give users the tops in file performance (plus the tops in file *value*) when the brand is Nicholson or Black Diamond. Available through industrial distributors and hardware stores.

• • •

READ MORE ABOUT FILE QUALITY, kinds, use and care in Nicholson's famous 48-page illustrated book, **"FILE FILOSOPHY."** It's ***FREE*** to school heads and instructors on individual requests.

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY • 47 ACORN STREET, PROVIDENCE 1, RHODE ISLAND**
(In Canada, Port Hope, Ont.)
BLACK DIAMOND TRADE MARK

NICHOLSON ... *A FILE FOR EVERY PURPOSE*

Vol. 41 No. 3

MARCH, 1952

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

Published on the 15th of month preceding date of issue

THE BRUCE PUBLISHING COMPANY, 400 North Broadway, Milwaukee 1, Wis. • CENTRAL OFFICE: 20 North Wacker Drive, Chicago 6, Ill. • EASTERN OFFICE: 225 Broadway, New York 7, N. Y.

★ ★ ★ ★

This Month's Cover

The picture chosen for the 1952 School Shop Annual, the March issue of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine, was submitted by Dr. William J. Micheels, professor of industrial education at the University of Minnesota.

It shows an Industrial Education Club team which is giving a demonstration of plastic work at a meeting of the Southwestern Minnesota Industrial Arts Club in Redwood Falls, Minn.

★ ★ ★ ★

Entered January 2, 1914, as Second-Class Mail Matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1952, by the Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, November 25, 1930. Published monthly except during July and August.

Subscription Information. — Subscription price in the United States, Canada, and countries of the Pan-American Union, $3.00 per year, payable in advance. Postage, foreign countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents.

Discontinuance. — Notice of discontinuance of subscription must reach the Publication Office in Milwaukee, at least fifteen days before date of expiration. Notices of changes of address should invariably include the old as well as the new address. Complaints of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for upon publication. In all cases manuscripts should be accompanied by full return postage.

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

TABLE OF CONTENTS

Shop Planning

The New Industrial-Arts Section at Ball State Teachers College ..... *Fred J. Schmidt, Jr.* 63
Industrial Arts at Wisconsin State College, Platteville, Wis. ..... *Harry A. Pederson* 71
The Industrial-Vocational Addition to Piqua High School ..... *W. K. Dunton* 76
A Practical Small General Shop ..... *George A. Willoughby* 79
A Composite Industrial-Arts Shop .... *George A. Willoughby* and *Ralph Gilden* 80
Development of Industrial Arts in the Beloit Public Schools .... *Fred S. Darling* 81
Home Workshops or Work Areas ..... *George A. Willoughby* 83
School Shop Planning With 3-Dimensional Scale Models .. *Arthur D. Anderson* 85
Northeastern State College Industrial-Arts Building, Tahlequah, Okla. ..... *M. E. Franklin* 86
The Elementary Industrial-Arts Experiment at Suffolk, Va. ..... *Fred W. Culpepper, Jr.* 88
Lighting the Industrial-Arts Laboratory ..... *E. C. Harrison* 90
Well-Lighted Activity Rooms 92
Tool Storage Locker ..... *A. A. Sinisi* 106

Instructional Materials

Outline of Proposed Activities for Fundamentals of Electricity .. *F. E. Robinson* 93
Basic Photography Course ..... *Harry A. Goldstein* 94
Course of Study for the Graphic Arts Shop ..... *John M. Fontana* 95
Basic Vocabulary for Painters and Decorators ..... *Ernst H. Suerken* 97
Analysis of Model Aircraft Construction ..... *Robert R. Lynch* 98
Information Sheet — Designing a Project ..... *Wallace Fillingham* 107
Scientific Anecdotes for the Electrical Shop ..... *Rod Hobson* 28A

Miscellaneous

Evaluation in Electricity ..... *Alan R. Pawelek* 99
Film Projector Operation in General Shop ..... *Robert W. Innis* 100
Twins, Although Not Identical ..... *Sylvan A. Yager* 101
The Psychological Effects of Color Dynamics ..... *M. Charles Hansen* 103
What's Your Professional I.Q.? ..... *Benjamin J. Novak* 104
Big Business Must Help Vocational Education ..... *Oakley Furney* 110
Test on Woods and Their Uses ..... *Amos G. Williams* 61A
The Absolute Viscosity of Water at 20°C. 72A
Safety Facts and Suggestions 84A

Problems and Projects

Multi-Compartment Storage Rack or Cabinet ..... *E. A. Rerucha* 107
Masonite Tool Board and Bench Top 109
Night-Signal Wrist Strap ..... *John S. Lorr* 110

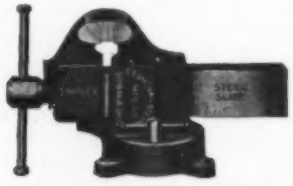
Equipment and Supply List

Metalworking 30A
Automotive 40A
Electricity 50A
Woodworking 54A
Print Shop 64A
Drafting 66A
Association News 4A
Personal News 26A
News Notes 74A
New Publications 78A
Shop Equipment News 86A

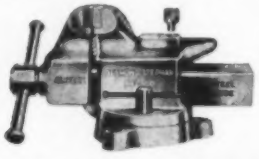
DESMOND-SIMPLEX

the complete line of quality vises for school shops

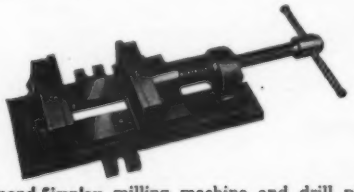
● Whatever your vise requirements — machinists, filers, weldors, milling machine and drill press, combination pipe, wood workers — specify Desmond-Simplex and you'll get the best quality that money can buy. Yet you'll pay no more than ordinary vises.



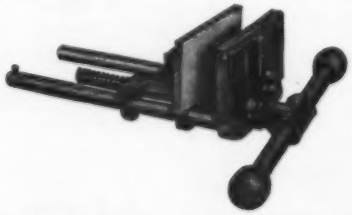
Only **Desmond-Simplex** has the STEEL SLIDE, guaranteed against breakage for the life of the vise. Steel screw is fully enclosed for complete protection. Outside screw retainer permits easiest lubrication. Hardened jaw inserts fit on shoulder in casting, stand heaviest blows, are easily replaced.



Desmond-Simplex Utility Vise has the most features at the lowest cost — hardened jaw inserts; pipe jaws; hardened cut off tool; anvil with horn; steel channel slide encloses screw; swivel base; non-pinching type handle. Four sizes for all requirements.



Desmond-Simplex milling machine and drill press vises are precision made, have maximum ruggedness for long service.



Desmond-Simplex woodworkers vises come in nine models. Quick-acting or continuous screw; with or without dog in front jaw; steel or wood handles. Extra heavy, quality construction insures maximum life in hard usage.

The complete Desmond line is stocked and supplied through leading industrial distributors.

DESMOND-SIMPLEX

STEEL SLIDE VISES

The Desmond-Stephan Mfg. Co. Urbana, Ohio.

ASSOCIATION NEWS

COMING CONVENTIONS

Mar. 20–22. New Jersey Vocational and Arts Association, at Hotel Berkeley-Carteret, Asbury Park, N. J. Secretary, R. O. Harthmann, 63 Lexington Ave., Jersey City, N. J.

Mar. 27–29. Indiana Industrial Education Association, at French Lick Hotel, French Lick, Ind. Secretary, H. G. McComb, 215 State House, Indianapolis, Ind.

Mar. 27–29. Ohio Industrial Arts Association, at Deshler-Wallick Hotel, Columbus, Ohio. Secretary, H. F. Edgar, Wauseon, Ohio.

Mar. 27–29. Southeastern Arts Association, at Tutwiler Hotel, Birmingham, Ala. Secretary, Ruth Harris, 111 W. 11 Ave., Johnson City, Tenn.

Mar. 28. North Carolina Vocational Association, at George Vanderbilt Hotel, Asheville, N. C. Secretary, M. D. Thornburg, Room 432, Education Bldg., Raleigh, N. C.

Mar. 28–29. Louisiana Industrial Education Conference, at Louisiana State University, Baton Rouge, La. Chairman, N. A. Hauer, head, dept. of industrial education, Louisiana State University, Baton Rouge, La.

Mar. 31–Apr. 3. National Vocational Guidance Association, Inc., at Biltmore Hotel, Los Angeles, Calif. Secretary, C. B. Beard, 1424 — 16th St. N.W., Washington, D. C.

Mar. 31–Apr. 4. North Central Association of Colleges and Secondary Schools, at Palmer House, Chicago, Ill. Secretary, C. W. Boardman, University of Minnesota, Minneapolis, Minn.

♦ The Midwestern Ohio Industrial Arts Association, affiliated with the American Industrial Arts Association, completed its program for the rest of the school year. The schedule of meetings is as follows: February 20, Administration Night, Bowling Green, Ohio; March 19, Project Night, Spencerville, Ohio; April 16, Ladies Night and Fish Fry, Port Clinton, Ohio.

The above meetings are held in the respective high schools. — *Harry R. Adams,* publicity chairman.

♦ The Maryland Vocational Association convened in the Lord Baltimore Hotel, Baltimore, Md., on October 19, with 147 members and guests in attendance.

President Gordon E. Medinger acted as chairman. Greetings were extended by Dr. Charles W. Sylvester, assistant superintendent in charge of vocational education, Baltimore. He was followed

(Continued on page 6A)

— Photograph submitted by Sylvan A. Yager

Epsilon Pi Tau, Mu Chapter initiates at Indiana State Teachers College, Terre Haute, Ind.

First row: Donald Williams, John Schneider, Warren Warken, Walter Mendel, William Fegely, Stewart Johnson, John Dunk, George Defel, Martin Coble, Glenn Blackburn

Second row: Ursa Walker, Joseph Dreren, Prof. Tranbarger, Robert Morris, George Turner, Joe Vidal, Milton Schlatter, Prof. Lushring, Frank Springman

Third row: Prof. Yager, Hubert Reid, John Perry, Prof. Harold Snidow, faculty trustee; Prof. Berry Morton, Tom Farlow, vice-president; Prof. Harry Barrick, Joe Grenda, chapter president; Winfred Kalkwarf

Back row: Leon Hunt, past president; Hugh Barnes

Like meeting an old friend...

...when students are trained on BLACK & DECKER TOOLS!

Using Black & Decker Tools to train your students helps ease the switch from school to shop. That's because Black & Decker Tools are most popular in shops throughout the country . . . they're the tools your students will meet most in industry!

What's more, students—and teachers—find Black & Decker Tools dependable . . . easy to use . . . easy to learn on. Built-in safety devices cut down beginner nervousness. *And B&D Tools cost you less in the long run because they outlast cheaper types!* See your nearby B&D Distributor for complete information. Write for free catalog to: THE BLACK & DECKER MFG. CO., 680 Pennsylvania Ave., Towson 4, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

*Trade Mark Reg. U. S. Pat. Off.

KESTER FLUX-CORE SOLDER

SO SIMPLE to teach the best Soldering Practice

Simplicity of use is one of many features that has created satisfied users everywhere, in every commercial field.

Your use of Kester Acid-Core and Plastic Rosin-Core Solders in the classroom will result in creditable results . . . for you and the student!

TWO FREE MANUALS: One for the instructor and a modified version for the student.

KESTER SOLDER COMPANY
4257 Wrightwood Ave., Chicago 39
Newark 5, New Jersey • Brantford, Canada

KESTER SOLDER

(Continued from page 4A)

by Maryland State Director of Vocational Education Dr. John Seidel's introduction of guests.

Maryland State Superintendent of Schools Dr. Thomas G. Pullen, Jr., then introduced the speaker of the evening — Dr. Kenneth B. McFarland, educational consultant, General Motors Corporation. Dr. McFarland stressed the need for continual vocational guidance through school and after.

Dr. Sylvester presented a framed citation to Allan Robinson, retiring principal of the Mergenthaler School of Printing, for his outstanding contributions to the printing industry and vocational education.

At the annual business meeting, the following new officers were elected: Palmer Hopkins, president; Kenneth Horvath, vice-president; Anna Meeks, secretary; and James O. Proctor, treasurer.

♦ The Industrial Arts Club of Ball State Teachers College have elected the following officers for 1951–52:

President, Stanley Ross; vice-president, Bob Smith; secretary-treasurer, Milton Ross; and sponsors, Bernard Josif and Willard Allen.

♦ The 1951 AVA Convention meeting of the National Agricultural Teachers' Association was called to order by Chairman G. R. Cochran, Minnesota state supervisor of agricultural education, on November 27.

At this meeting Dr. Earl McGrath, U. S. Commissioner of Education, explained the purpose of his recent mission to Iraq, Lebanon, Jordan, and Israel was to assist persons in these countries in improving their lot in the world. He said that living conditions in those countries exhibited extreme poverty, and added that "the greatest need . . . is a good vocational agricultural program."

James J. Wallace, manager, Agricultural Foundation Farms, Iowa State College, outlined the policy and planning involved in the ten demonstration farms that he directs.

Dr. Byrn Shaw, deputy administrator, Agricultural Research Administration, U. S. Department of Agriculture, spoke on "Today's Research Shapes Tomorrow's Future."

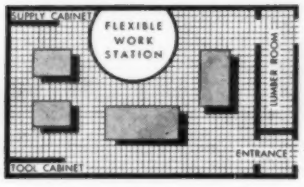
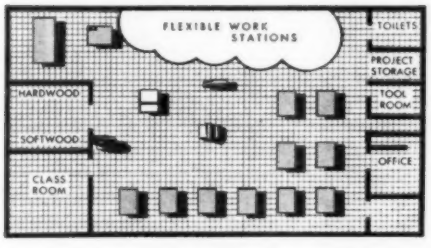
♦ The Southern Section of the California Industrial Education Association held its annual convention at Westchester Junior-Senior High School, Los Angeles, on Saturday, January 12, 1952. President Lyman Goldsmith presided over a short business meeting and introduced the speaker of the morning session, Dr. Heber A. Sotzin, director, Industrial Arts Education Division, San Jose State College. Dr. Sotzin spoke on "Meeting the Challenge of Modern Education" to over eight hundred men in attendance.

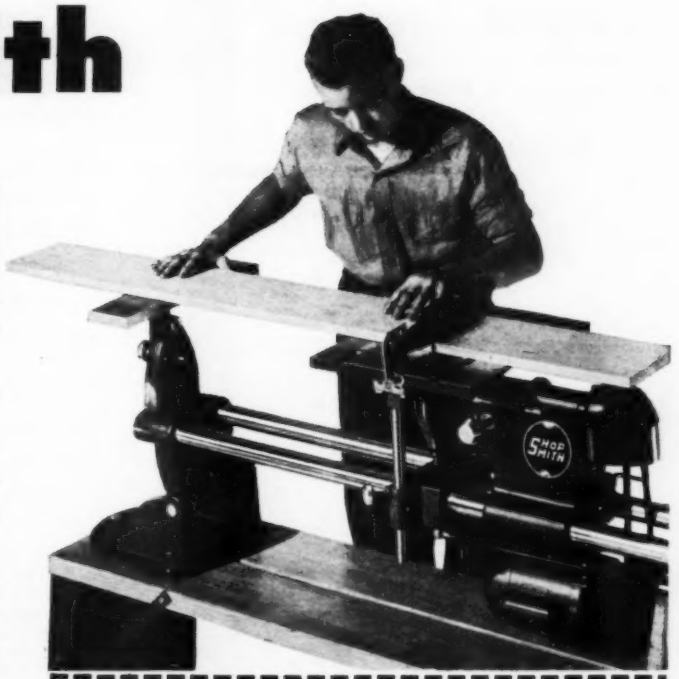
Following the luncheon, convention participants took part in section meetings geared to the theme "Improving Instruction Through Instructional Aids." Section meetings were held in the areas of student industrial-arts clubs, general metal, woodwork, electricity and radio, machine shop, auto, handicraft, drafting and graphic arts.

FOURTH ANNUAL INDUSTRIAL EDUCATION CONFERENCE

The Fourth Annual Industrial Education Conference conducted by the Department of Industrial Education of The Pennsylvania State College, was held on October 13, 1951. Its theme was "The Place of Industrial Education in Meeting the Needs of the Sixty Per Cent Group." Approximately 250 vocational school administrators, supervisors, and teachers and industrial-arts teachers, as well as other school administrators attended the conference.

(Continued on page 26A)

No school's too small  ...or too large  ...for Shopsmith



It's easy enough to see where multi-purpose SHOPSMITH fits into the shop program of smaller schools. One SHOPSMITH takes the place of five individual tools – circular saw, disc sander, wood lathe, vertical and horizontal drill press. It saves space. And it means a better equipped shop on a lower budget.

But what place has SHOPSMITH in large, well-equipped school shops?

You find the answer in SHOPSMITH's *flexibility*. A shop that has several SHOPSMITHS is a *Flexible Shop*. It can be changed to meet the needs of any group of students, any projects, any teaching techniques. In the *Flexible Shop*, machines and students need never stand idle, since the SHOPSMITHS can be converted to relieve congestion or tie-ups. The shop operates at 100% efficiency. Students learn faster. Instruction becomes more effective.

Basic SHOPSMITH costs $189.50 without motor, $232.45 with ½-hp. motor and special school guards. It has been tested and approved by prominent industrial arts educators. Write for specifications of SHOPSMITH and information about the *Flexible Shop*.

Magna Engineering Corporation

SHOP SMITH

MAGNA ENGINEERING CORPORATION

Dept. 200-U, *at factory nearest you*
12819 Colt Road, Cleveland 8, Ohio, OR
Menlo Park, California

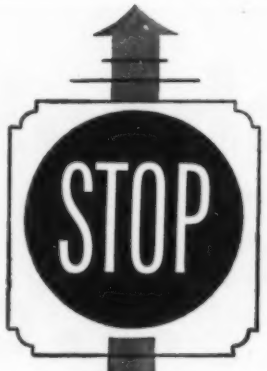
Please send me complete information about the *Flexible Shop* and the application of SHOPSMITH to industrial arts education.

*Name*_____ *Position*_____

*School*_____

*Address*_____

*City*_____ *State*_____



one **for your shop**

- BENCHES •
- CERAMICS •
- CRAFTS •
- ELECTRICAL SUPPLIES •
- FINE ARTS •
- FINISHING SUPPLIES •
- HARDWARE •
- LUMBER •
- MACHINERY •
- MECHANICAL DRAWING •
- METAL EQUIPMENT •
- METALS •
- TOOLS •
- WELDING EQUIPMENT •

one source of supply for all your shop needs

Yes, just one stop does it when you do your shopping at Brodhead-Garrett. You have your choice of thousands of quality products—all illustrated under one cover in the new B-G catalog.

You can make your selections from the old familiar stand-bys, improved models and materials and brand new items. And whatever you select, any and every item is covered by one complete guarantee.

One catalog—one company—one guarantee—makes it an easy, sure way to shop.

So, for shopping with confidence and convenience, look to Brodhead-Garrett for all your shop needs.

Use your copy of the current B-G catalog today. Over 12,500 items are described and illustrated in this big book. Indexed alphabetically, it's easy to find just the things you want for industrial arts, vocational training, fine arts and crafts.

BRODHEAD-GARRETT CO.

4560 EAST 71 STREET CLEVELAND 5, OHIO

Time is running out—decide right now to enter the DELTA SCHOOL LAYOUT CONTEST

DEAD-LINE – JULY 31, 1952

WHAT THIS CONTEST IS ALL ABOUT

Just to refresh your memory about this contest, it is sponsored by the makers of Delta Power Tools for the purpose of gathering and presenting the most advanced thinking on modern efficient school shop layouts.

You are urged to submit your ideas on this subject—as one of the men best qualified to know school shop requirements, now and in the future.

At the close of the contest the best plans submitted are to be assembled in book form—as a service to school men throughout the world.

IT'S EASY TO ENTER

All you do is send for the Delta Official Contest Kit. It contains all the information you need—Contest Rules and Instructions, Entry Form, Official Floor Plan sheets and full directions on how to prepare your entry.

Important: There's time enough to prepare your ideas *if you act now!* July 31 midnight is the dead-line—and it's getting closer.

WHO DETERMINES THE WINNERS?

As you also know, the contest entries will be submitted to a panel of five distinguished judges, all leaders in the field of Industrial Arts and Vocational Education—

DR. C. C. CAVENY
Dean, Chicago Campus—University of Illinois

DR. C. H. GRONEMAN
Head, Industrial Education—Texas A. & M. College

HANS W. SCHMIDT
Former Building Service Supervisor—Wisconsin State Dept. of Education

DR. W. W. THEISEN
Ass't. Supt. of Schools—Milwaukee Public Schools

GILBERT G. WEAVER
Director of Training—State Education Dept., New York, New York

The decision of the judges will be final, of course; and all entries will be the property of Delta Power Tools

Your Golden Opportunity!

COMPETE FOR ONE OF THESE

37 VALUABLE PRIZES

1st PRIZE:

$1000 worth of Delta Tools — your own selection — for "The Best School Shop Layout"

6 PRIZES:

Each $350 worth of Delta Tools — your own selection — for the best school shop layout in each of the following six divisions:

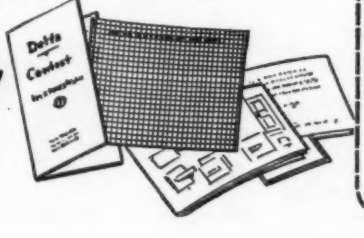
1. Elementary School Shops—7th and 8th Grades
2. High School Shops—9th to 12th Grades
3. Junior High School Shops—7th, 8th, 9th Grades
4. Senior High School Shops—10th, 11th, 12th Grades
5. Technical High School Shops—Trade Schools, Vocational, Continuation and Part-Time and Adult Education Schools.
6. Technical Institute Shops—high school post-graduate courses or 13th and 14th grades.

30 other desirable prizes

You may submit entries in as many divisions as you want. All you need to do is fill in the coupon and send it to Delta. You'll receive an Official Contest Kit containing:

- Contest Rules
- Official Contest Floor-Plan Sheets
- Contest Instructions
- Official Entry Form

To Get the Official Delta Contest Kit—
SEND THE COUPON



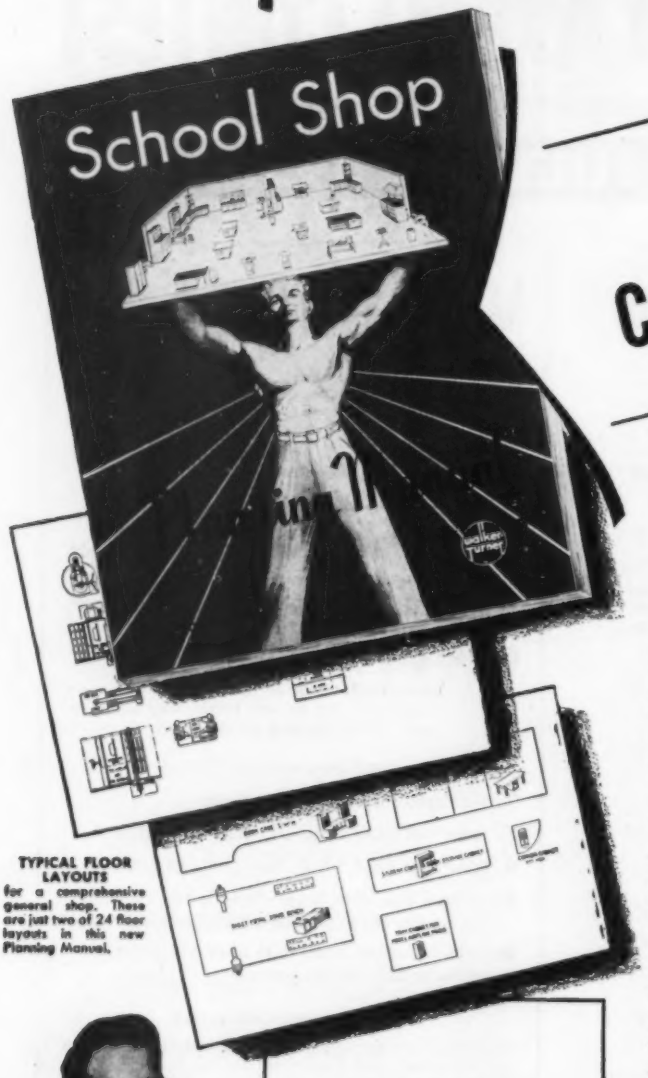
DELTA POWER TOOL DIVISION
DELTA MILWAUKEE
Rockwell
MANUFACTURING COMPANY
703C EAST VIENNA AVENUE • MILWAUKEE 1, WIS.

☐ Please send me the Delta Official Entry Kit for the Delta School Shop Layout Contest

Name _____
Position _____
School _____
Address _____
City _____ Zone _____ State _____

You'll want both of these

New Comprehensive MANUAL



TYPICAL FLOOR LAYOUTS for a comprehensive general shop. These are just two of 24 floor layouts in this new Planning Manual.

F. C. Finsterbach is eminently fitted to prepare a manual such as this on school shop planning. His experience includes: 25 years teaching at Cleveland, Ohio; Buffalo, N. Y.; Oswego State Teachers College; Oregon State College. B. S. from Buffalo State; M. S. at Wayne University; Doctoral studies at University of Buffalo. Contributor to A. V. A. Journal, Industrial Arts and Vocational Education, and School Shop Magazine. Former supervisor New York State Education Department and recently Assistant Professor of Industrial Arts. Now Director of Education, Walker-Turner Division, Kearney & Trecker Corporation. Member Epsilon Pi Tau and Phi Delta Kappa.

Partial List of Contents

- ★ Major Essentials for School Shop Planning
- ★ Illustration of Planning Principles
- ★ Architectural Details
- ★ The Planning Center in a School Shop
- ★ Suggested Equipment for a Comprehensive General Shop

for successfully planning your school shop

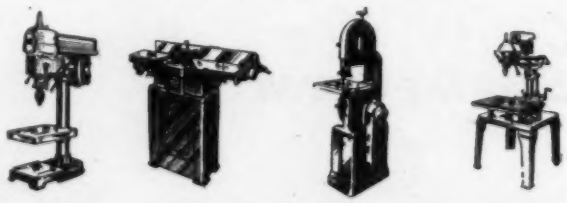
48 pages (8½" x 11") Over 750 silhouettes of shop equipment

Here, for the first time, is a manual which deals with the problem of school shop *planning*—deals with it practically and authoritatively. In point of view, as well as content, it marks a radical departure from other manuals in the fields of Industrial Arts and Vocational Education.

The author of "School Shop Planning" recognizes that there are essential differences stemming from the aims or purposes of each branch of industrial education, and that "the planning of the shop (should) reflect these differences, not so much in arrangement but in multiplicity of equipment, and in emphasis of instruction".

You will find, in this 48-page Manual published by the Walker-Turner Division of Kearney & Trecker Corp., not only floor layouts and silhouettes of the proved Walker-Turner power tools, but those of other equipment. In addition, certain of the commonly accepted practices have been included as "standards", together with equipment lists of a basic nature.

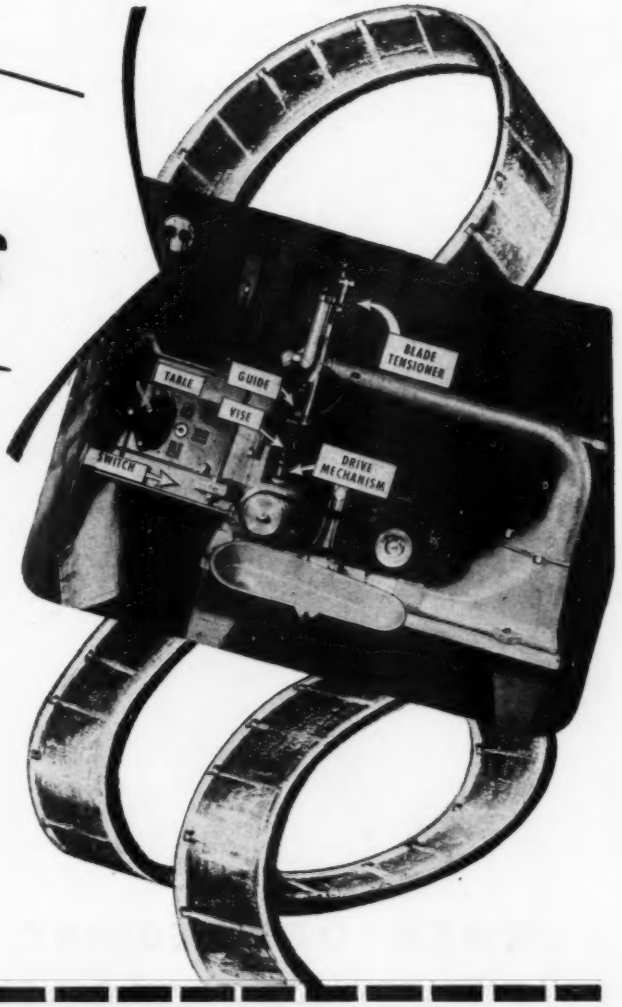
In short, whatever your needs or problem, you will receive from this profusely illustrated Manual helpful suggestions and assistance of a *tangible* nature for successfully planning your school shop. Use coupon at right to order your copy (the cost is nominal). Enclose check or money order and mail *today*.



DRILL PRESSES JOINTERS METAL-CUTTING BAND SAWS RADIAL DRILLS

WALKER-TURNER *Teaching Aids*

New Educational STRIPFILMS



for graphic instruction in machine operation

produced in cooperation with Popular Science Magazine

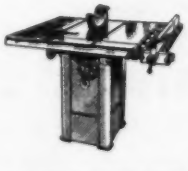
You can teach and train students in the use of machines *faster*, and more *thoroughly*, with this series of six educational stripfilms. Produced by Walker-Turner, in cooperation with Popular Science Magazine, each film demonstrates the correct way to use one of the power tools usually found in school shops.

Here are step-by-step directions for performing the basic operations on the Jig Saw, Drill Press, Band Saw, Shaper, and Circular Saw. Students not only learn how the machine *works*, but how its many parts are interrelated, and how they may be adjusted and set up to perform specific operations.

Visual aids are becoming more and more essential to effective teaching in our machine age. Walker-Turner's new Educational Stripfilms, covering approved shop practices, *belong* in the modern school shop curriculum. Use coupon to order yours.

WALKER-TURNER
walker-Turner DIVISION
KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

BELT and DISC SURFACERS



TILTING ARBOR SAWS

SPINDLE SHAPERS

WALKER-TURNER DIVISION
Kearney & Trecker Corp., Educational Dept. IA3
Plainfield, N. J.

Attached find check (Money Order) in amount of $.....for .... copy (copies) of the new Walker-Turner Manual, at the nominal price of $1.00 per copy.

☐ set of 6 Stripfilms at $31.50 per set.

☐ Please send complete details on Stripfilms.

Name..... Position.....

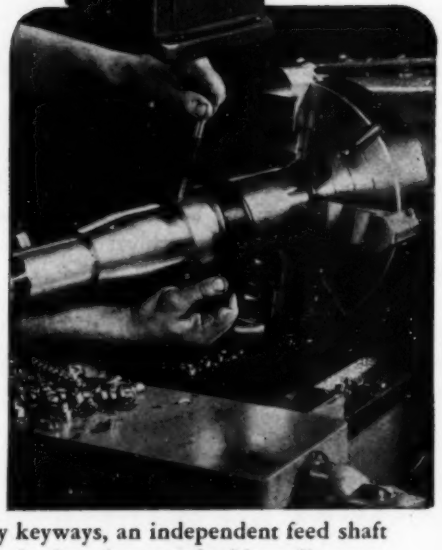
School.....

Address.....

City..... Zone..... State.....

SCHOOL ROOM ACCURACY *becomes* TOOL ROOM ACCURACY

with



ROCKFORD *ECONOMY LATHES*

That's why we say it's the best lathe value on the market today. Built by expert machine tool mechanics from high quality materials, it has sufficient weight and power to stand up under general production and maintenance use, and still provide the accuracy requirements needed for the tool room.

Design features include a big, accurate lead screw, uninterrupted by keyways, an independent feed shaft with an interlocking safety clutch, a handy thread cutting dial as standard equipment, double wall apron, drop-lever feed engagement and every other essential found in a high-quality lathe.

Any of our representatives will give you full specifications on the medium-sized, economy-priced Rockford Economy Lathe, or we will gladly send on request a copy of our bulletin No. 900G

MEDIUM-SIZED
ECONOMY-PRICED

ROCKFORD ECONOMY LATHES — 16" and 18"

521

ROCKFORD MACHINE TOOL CO. • ROCKFORD, ILLINOIS

Fine Tools at their BEST

MILLERS FALLS TOOLS

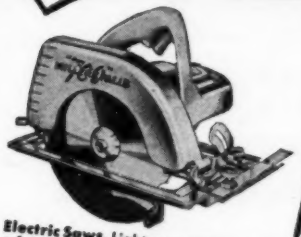
SINCE 1868 ®

Planes for every purpose — Block, Bench, Rabbet and Router. All built to the highest standards of excellence in design, workmanship and finish.

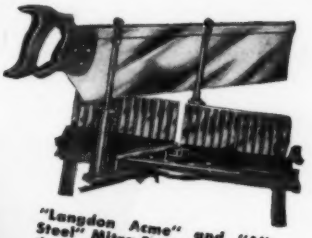
World's broadest, most advanced line of metal-cutting saws and bands, including "Tuf-Flex"® and "Blu-Flex"® hand blades, "Blu-Mol"® and "Jet-Edge"® power blades.

Hack Saw Frames. A wide variety of styles and types. Sturdy, well-balanced, with firm, comfortable grips — each an outstanding value in its field.

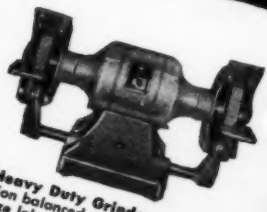
Levels of Lasting Accuracy. Lightweight Aluminum models. Wood levels of finest straight-grain white pine. Handy, low-cost Torpedo and Line Levels.



Electric Saws. Light, compact, powerful. New high-capacity 7" model weighs only 11 lbs. Also 9" and 10" heavy duty types for continuous, production work.



"Langdon Acme" and "All-Steel" Mitre Boxes. For years, the first choice of professionals for fast, easy, accurate work.



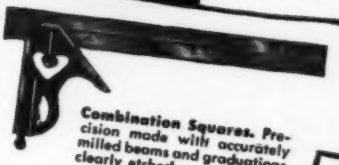
Heavy Duty Grinders. Precision balanced motors and oversize labyrinth-sealed ball bearings for smooth operation under heavy loads. 6", 7" and 10" wheels.

Electric Drills, Screw Drivers and Nut Runners. A wide range of high-capacity tools for industry and general utility, including the famous "Dyno-Mite"® line.

Screw Drivers — Plain, Ratchet and Offset. Highest quality alloy steel. Each blade torque tested to rigid standards.

Automatic Drills. A famous line, known the world over for quick, one-hand, small-hole boring.

Bit Braces. Traditionally, the world's top-line of quality braces. Plain and Ratchet models for every need and every pocketbook.



Combination Squares. Precision made with accurately milled beams and graduations clearly etched — not stamped — on blades.

Spiral Ratchet Screw Drivers. With or without return spring. Fast and smooth-acting. Drive and draw screws automatically.

Hand and Breast Drills. Sturdy, smooth-acting, built for a lifetime of fine performance. The favorites of experts for more than half a century.

No. 725 "Nest of Saws." Cuts most anything most anywhere. Blades turn and lock in 8 positions. One of the handiest tools a man can own.

For generations, craftsmen have known you can always count on Millers Falls for the newest and best in tools. Send for Catalog 49 — 176 pages illustrating and describing the greatest line in Millers Falls 84 years of quality toolmaking.

MILLERS FALLS COMPANY
Greenfield, Mass., U.S.A.

GET YOUR FREE COPY!

● This new 20-page booklet provides many useful how-to-do-it ideas for both students and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. It contains 46 action illustrations and describes and illustrates 47 popular Crescent and Crestoloy Tools.

Simply fill in and mail the coupon, and a sample copy will be sent to you with our compliments.

CRESCENT TOOL COMPANY
JAMESTOWN, N. Y.

WRENCHES . . . . . and how to use them

A prime rule in using any adjustable wrench is to first adjust it to a snug fit on the nut to be turned. (Fig. 7.) A tightly adjusted wrench is safer since danger of slippage is minimized. A loosely fitted wrench will tend to "round" the corners of hexagonal objects, and may damage the wrench by exerting undue strains on the jaws. Greasy, oil-covered tools are dangerous. Keep handles clean and dry by occasional wiping. Oil should be applied sparingly to moving parts.

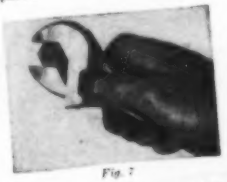


Fig. 7

Adjustable Wrenches develop their greatest strength when hand pressure is applied to the side of the wrench carrying the fixed jaw as in Fig. 8. They can, however, be pulled in either direction on moderate loads, and are frequently "flopped" between

Fig. 8

swings to gain an angular advantage and permit continuous rotation of nuts or bolts where cramped quarters limit the handle swing.

"Crestoloy" Wrenches, being thinner (and stronger) than "Crescent" Wrenches, are the preferred tools for use in cramped quarters or when adjustable wrenches are used in pairs as in Fig. 9. For extremely heavy loads, Crestoloys are likewise recommended. (See tools illustrated page 15.)

Fig. 9

PLIERS . . . . . and how to use them

Slip Joint Pliers

Crescent Slip Joint Pliers are a general purpose tool having excellent gripping power over a wide capacity range because of their adjustable jaws. Ideal for holding or turning round pieces. Should not be used on nuts or bolt heads. (See tools illustrated page 15.)

Fig. 10

Skinning Insulated Wire

Fig. 12 illustrates the proper way to grasp a light, diagonal plier. The third and little finger "inside" the handles provide pressure to hold the jaws apart. Pressure of the thumb stabilizes the tool and maintains desired jaw opening.

To skin wire, grasp it as shown with the left hand, as in Fig. 11. Now with plier held, as shown, close the jaws sufficiently to cut through the insulation *only*. Don't cut through the conductor!

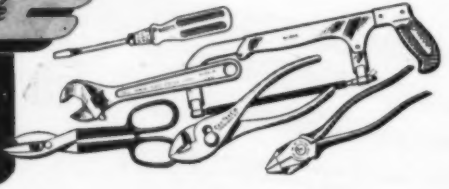
Fig. 11

Now "rock" plier handles toward left wrist and the prying action will strip the insulation from the wire end.

"Cleaning" or brightening of the bare wire is shown in Fig. 12. Close jaws just enough to provide slight pressure and draw cutter blades along the bare wire a few times. Rotate wire with left hand so that the entire circumference is clean. (See tools illustrated page 17.)

Fig. 12

CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence



"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.

MAIL THIS COUPON!

PLEASE MAIL CRESCENT BOOKLET TO:

NAME

ADDRESS

CITY & STATE

I-352

Keep Atlas Extra-Value Features in Mind When You Requisition New Tools

It's the *extra values* — features that assure easier operation, greater versatility, and lasting accuracy — that merit thorough consideration of Atlas when you select new tools. Send coupon for latest catalogs and free wall charts.

15" DRILL PRESS

15" floor and bench models include new operating features such as 4-ball bearing spindles, wider head support bearings for maximum rigidity, new depth control stop, smoother operation.

24" JIG SAW

The finest on the market. 14" x 14" precision-ground tables tilt right and left, swivel 90°. Four speeds for wood, metal, plastic, composition. Cuts 2¼" thick. Chucks index 90°.

12" BAND SAW

The ideal size for school shops. 14" x 14" precision-ground table tilts 45° Cuts stock to 6¼" thick. Ball bearing wheels and blade supports.

10" SAW

The ultimate in fine saw construction at low cost. Cuts 3¼" deep. 35" x 27½" precision-ground table, 18" right of blade, 13" ahead of blade, quick-positioning fence with vernier control.

SPINDLE SHAPER

15" x 21" precision-ground table. Table adjusts vertically, stationary spindle for smoother cutting. Ball bearings.

BELT & DISC SANDERS

Sands any width boards, angles, curves, metals, plastics for complete sanding instruction. 10" disc, 4" belt, table tilts 45°.

10" AND 8" SAWS

Handle circular sawing needs at lower cost. 8" saw (shown) cuts 2⅛" deep; precision-ground table 35½" x 22" with 2 extensions, 10⅝" ahead of blade.

12" WOOD LATHE

36" between centers. Sealed-for-life ball bearings. Lever locks on tailstock and tool support base — no wrenches to lose. 4 speeds.

6" JOINTER

The last word in jointer design and construction. 42" long precision-ground table, 32" x 4½" fence supported close to cutter head. Stationary accurate alignment.

Atlas PRESS CO.
371 N. Pitcher St.
Kalamazoo, Michigan

DEPENDABLE QUALITY TOOLS SINCE 1911

☐ **Please send your latest woodworking tool catalogs and ☐ free wall charts.**

NAME.....

SCHOOL.....

ADDRESS.....

CITY, STATE.....

BOYAR-SCHULTZ TOOLROOM GRINDERS

Wherever Boyar-Schultz Grinders have been installed, their design, quality of materials and unexcelled workmanship are quickly recognized.

In shops where accurate, close tolerance work is necessary, skilled mechanics turn instinctively to Boyar-Schultz Grinders, knowing that these tools give fullest expression to their ability.

With Boyar-Schultz Grinders in your shop or tool room, you are sure you have the best your tool dollar can buy.

Write for circulars.

No. 6-12 SURFACE GRINDER

A precision Machine Tool built to provide the close tolerance performance that has long been associated only with larger, costlier grinders. Users say that Boyar-Schultz No. 6-12 Surface Grinder produces flatness, horizontal and vertical tolerances comparing with other grinders regardless of size.

No. 2 PROFILE GRINDER

A Profile Grinder for larger and heavier work. Made in two styles—Single or Dual Spindle. Designed for such heavy work as aircraft, automotive and locomotive building, and other heavy profile grinding.

No. 1 PROFILE GRINDER

A fast operating precision Machine Tool for saving time in grinding odd and irregularly shaped surfaces; fitting dies and punches and other time consuming grinding jobs.

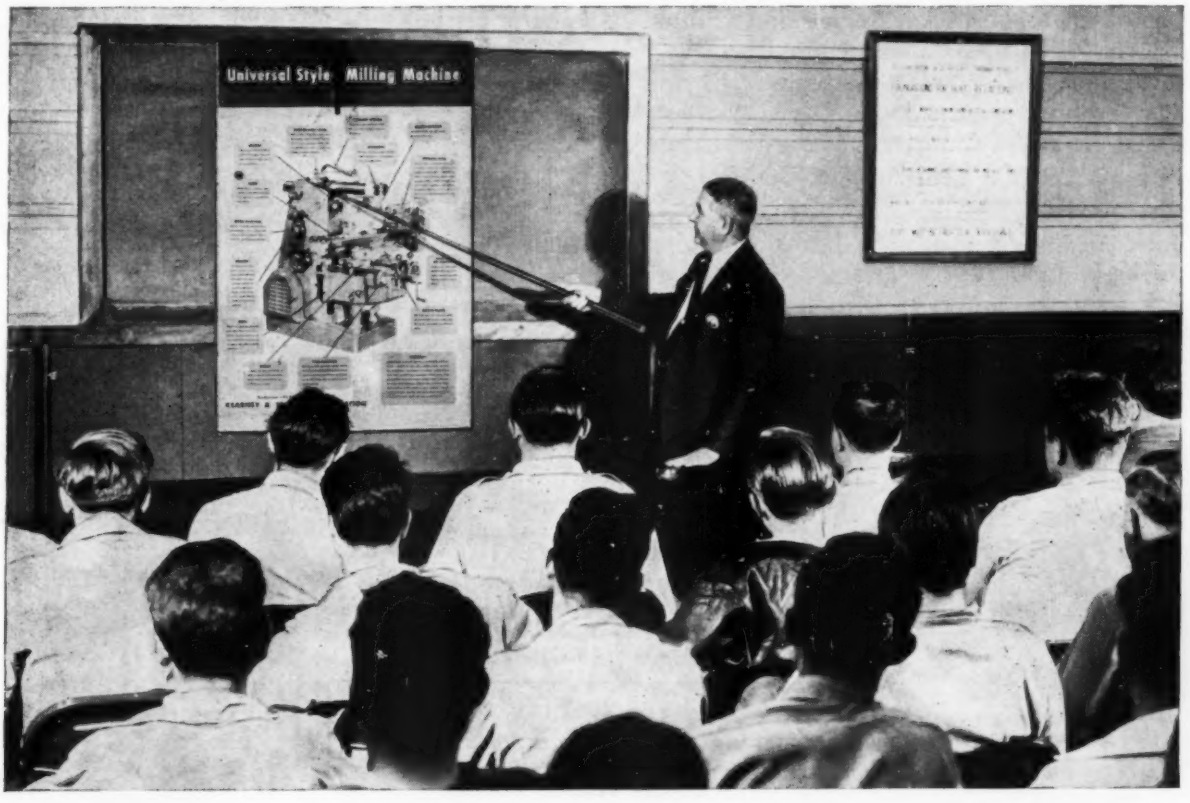
No. 6-18 SURFACE GRINDER

An extremely accurate Grinder for tool room work and gage grinding, as well as production. Rugged construction and superior engineering assure accuracy over a long period of usefulness.

BOYAR-SCHULTZ CORPORATION

2103 WALNUT STREET • CHICAGO 12, ILLINOIS

HOW TO SPEED UP TRAINING OF MILLING MACHINE OPERATORS



Kearney & Trecker visual training aids can make your teaching job much easier

FILM COURSE — We will loan you, without charge, a complete sound-slide, five-part training film (in color) which deals with good machine tool practice. Special emphasis on the purpose and use of the milling machine. Complete with instructor's guide.*

ELEMENTARY HANDBOOKS — Book I, "The Right and Wrong in Milling Practice," covers operation of the milling machine including job setup, taking the cut, selection and care of cutters, housekeeping and safety precautions. Book II, "The Milling Machine and Its Attachments" covers the principles of milling machine design, construction and attachments. Books I and II are 50 cents each. Make remittance out to Kearney & Trecker Corp., Milwaukee 14, Wisconsin. Check or money order.* No C.O.D.'s or stamps please.

POSTER STUDYVIEW OF UNIVERSAL STYLE MILLING MACHINE — This big 40" x 60" color studyview of a universal milling machine gives the beginner a clearly defined illustration of the machine, its construction and elements of operation and maintenance. No charge.*

**All requests should be made on official school letterhead. Trainees can make individual purchases of Books I and II without official letterhead. Instructors can make group purchases of Books I and II.*

Today, more than ever, it's important to speed up training of milling machine operators.

That's why — as a service to vocational and industrial education — Kearney & Trecker offers three visual training aids that make your job easier . . . and help you speed up this training so vital to the defense program.

You will find these visual aids will greatly simplify your job, regardless of the make of tools in your shop.

Look over the descriptive material and send for the training aids that will help you. Kearney & Trecker Corp., 6786 W. National Ave., Milwaukee, Wisconsin.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Give Your School Shop the Best Vise Equipment

MORGAN VISES

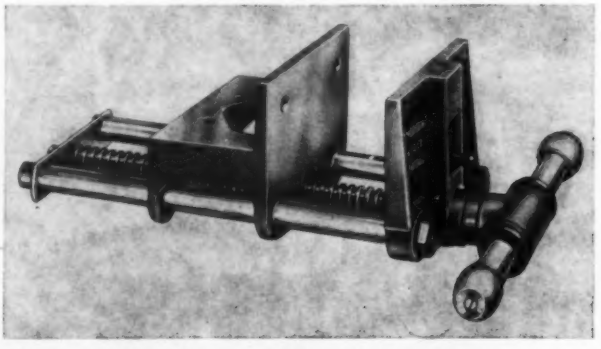
STRONG AND DEPENDABLE — Made of semi-steel casting, tested and proved by actual breaking strain. Strength *where needed.*

EXTRA RIGID — Special Morgan line feature . . . accurate machining of the sliding bar, working to close limits, insures extra rigidity.

FIRM GRIPPING POWER — Absolute tightness. Jaws are milled parallel and fitted with interchangeable tool steel faces, driven on the vise and held firmly with special tapered screws.

SMOOTH JAWS furnished at no extra charge on request.

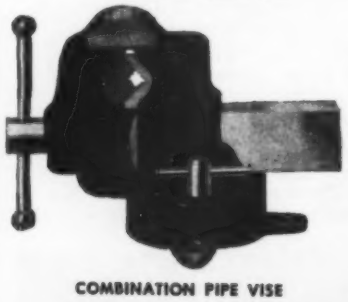
THE SCREW is a solid steel forging, closely gauged for gripping power. Snug-fitting NUT, easily replaceable.



Above: SOLID NUT — CONTINUOUS SCREW — WOODWORKING VISE — Built to withstand severe service — Extra Heavy Parts — Fully Machined — Furnished with either Hardwood *or* Steel Handle.

MACHINISTS' BENCH VISE
Solid Jaw and Stationary Base

MACHINISTS' BENCH VISE
Solid Jaw and Swivel Base



COMBINATION PIPE VISE

Engineered to Fit Every School Shop Requirement

MACHINISTS' BENCH VISE — Special semi-steel casting and accurate milling of the sliding bar characterize both the Stationary Base and Swivel Base vises. New, improved base on the swivel type vise.

COMBINATION PIPE VISE — Convenient, serviceable . . . embodies best features of machinists' vise.

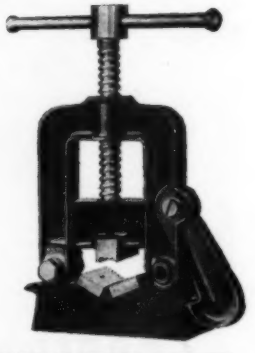
MORGAN HINGED PIPE VISE — Self-locking hook, cold rolled screw and handle, oil tempered tool steel pipe jaws . . . one of the finest pipe vises on the market.

MORGAN JUNIOR WOOD WORKERS' VISE — Continuous screw woodworking vise with stop in front jaw. Made of semi-steel castings. Fully machined. Hardwood handle.

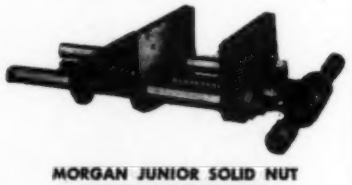
QUICK ACTION VISE — Simple working action. Screw with intercepted threads operates in a half nut. Slight turn of handle disengages the screw and permits jaw to slide back and forth. A turn in opposite direction engages screw with nut, holding work firmly in place.

All MORGAN VISES are fully guaranteed to be satisfactory in every respect. Teach your students the value and care of tools!

Write for our free catalog and prices to:



MORGAN HINGED PIPE VISE



MORGAN JUNIOR SOLID NUT WOODWORKING VISE

QUICK ACTION VISE

MORGAN VISE CO. 108-112 N. JEFFERSON ST., **CHICAGO 6, U.S.A.**

Training Aids

FOR YOUR SCHOOL SHOP PROGRAM

Instructors everywhere are finding it advantageous to use these Cincinnati training aids. There's no question about it . . the boys you train today will encounter CINCINNATI Milling, Grinding and Cutter Sharpening Machines in industry tomorrow. So why not take advantage of the material Cincinnati offers to school shop instructors? With these booklets and diagrams, students quickly grasp the fundamentals of machining and familiarize themselves more readily with the function and location of various units and controls of the machines. Copies will be sent to instructors free on request. Or they are available in quantities at a modest charge.

Recommendations for Carbide Milling . . . No. M-1614

Recommendations for Sharpening Carbide Milling Cutters . . . No. M-1714

Explaining the Centerless Principle with the aid of a Wood Model . . . No. G-509

Principles of Centerless Grinding . . . No. G-503-1

Look Sharp at Your Cutters . . . No. M-1657-2

Milling Machine Practice . . . No. M-773-1

Functional diagrams for a number of machines will be sent to school shop instructors on request. The diagrams, enlarged photos indicating the principal units and controls, are useful for classroom discussions. They are available for the machines listed below. Tables of leads and index tables, mounted on cardboard 14" x 18" for use with CINCINNATI Dividing Heads, are also available. If you are interested in information about two 16 mm color movies, "Highway to Production," and "Age of Precision," write us.

No. 2ML and 2MI Milling Machines
Dial Type Milling Machines
O-8 Vertical Milling Machine
No. 2 Cutter and Tool Grinder
No. 2 Centerless Grinder
12" Hydraulic Universal Grinder

Please address all requests for training aids to the Technical and Service Publications Dept., The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES
MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

TRAIN YOUR STUDENTS ON THE SAME

COLUMBIAN VISES

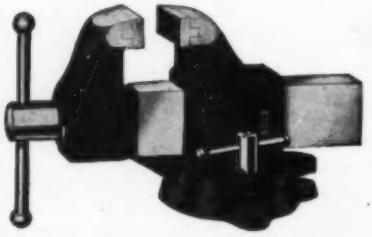
THEY WILL SOON USE IN INDUSTRY!

Your students, as they enter industry, will find Columbian Vises handling thousands of necessary jobs in leading industries.

So—why not train them on Columbian Vises today and prepare them properly for those essential production jobs on which they will use Columbian Vises tomorrow!

A-4749

HINGED PIPE VISES



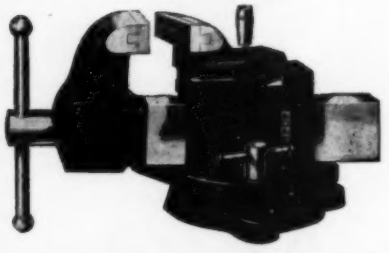
MACHINISTS' VISES

WOODWORKERS' VISES

there is a COLUMBIAN VISE for every need and purpose...

HYDRAULIC VISES

WORKSHOP VISES



ADJUSTABLE JAW—SWIVEL BASE VISES

COLUMBIAN Vises

The Columbian Vise & Mfg. Co.

CLEVELAND 4, OHIO

MANUFACTURER OF COLUMBIAN-STEVENS LEVELS

SHOP TEACHERS GET RESULTS WITH Logan LATHES

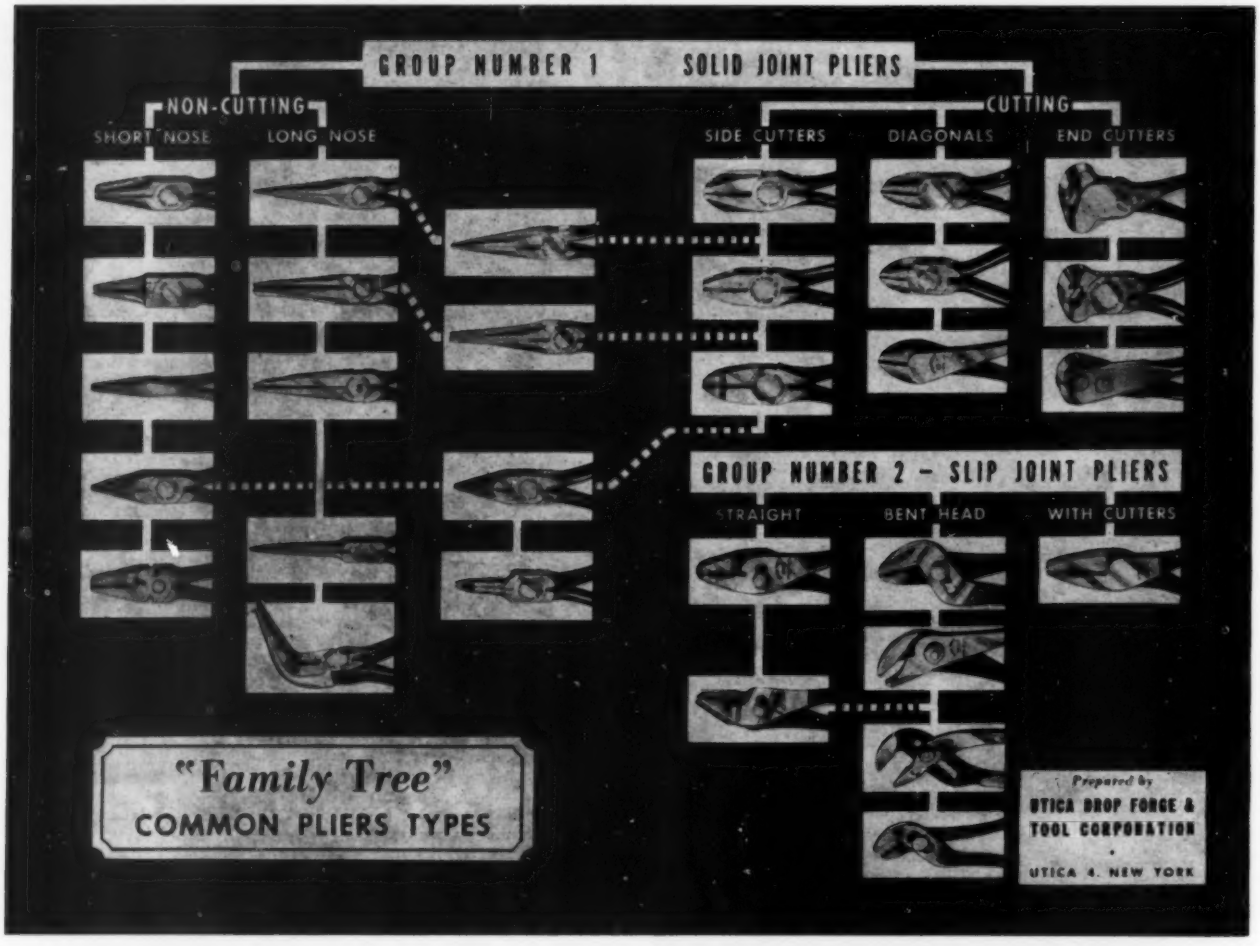
Battery of Logan Lathes in Shop of Eliot Junior High School, Pasadena, California

Write for catalog information on the complete line of Logan 10" and 11" Lathes and 8" Shapers.

THE features that make Logan Lathes top rank industrial tools are equally effective in school shops. Versatile Logans equip the instructor to teach every type of lathe operation. 11" swing, 1" collet capacity, 1⅜" spindle hole, and 24" and 36" center distances permit a wide range of projects involving work of substantial size. The student learns on the same accurate lathe he will later encounter in the shops and production lines of industry. For the young operator's safety, Logan design encloses the headstock, countershaft and motor; and makes controls and switches easily accessible. Rugged, durable construction assures sustained accuracy and dependable operation through extra years of school shop use. As for economy, no other lathes of comparable specification match the Logan low initial cost and low operating cost. For all these reasons, Logan Lathes provide the finest school shop training within range of the moderate budget.

LOGAN ENGINEERING CO.

4901 W. Lawrence Avenue • Chicago 30, Illinois



SIMPLE WAY TO EXPLAIN BASIC TYPES OF PLIERS

Have you seen Utica's "Tool User's Guide"?

It's chock-full of helpful instruction aids for the school shop. It is offered to you without charge and has the following contents:

TWO WALL CHARTS
"How to Use Pliers"
"Why Drop Forged Tools Last Longer"
(each 32" x 12", in two colors)

BOOKLET
"First Aid for Pliers"
8 pages on care and repair of pliers

FOLDER DESCRIBING AVAILABLE UTICA MOVIES
"Add Power to Your Hands"
"PLIERS: Their Use and Care"
(each 10 minutes, black and white, 16 mm)

PAMPHLET ON MOST POPULAR TOOLS

U TI CA

DROP FORGE AND TOOL
CORPORATION

UTICA 4 NEW YORK

FREE WALL CHART
"FAMILY TREE OF COMMON PLIERS TYPES"

To our knowledge, this is the only chart of its kind. Gives your pupils a quick, basic understanding of major pliers and their variations. We'll be glad to send you a copy for your classroom use – without obligation, of course.

IT PAYS TO USE QUALITY TOOLS

Cheap tools are like dull tools. They slow the job, make it more difficult. This is just as true with the beginner as with the expert. These instruction aids are made available to you and your students so that they can learn at the outset that quality, like that of UTICA, is the first step to long range economy.

SEND COUPON TODAY!

IAVE-3

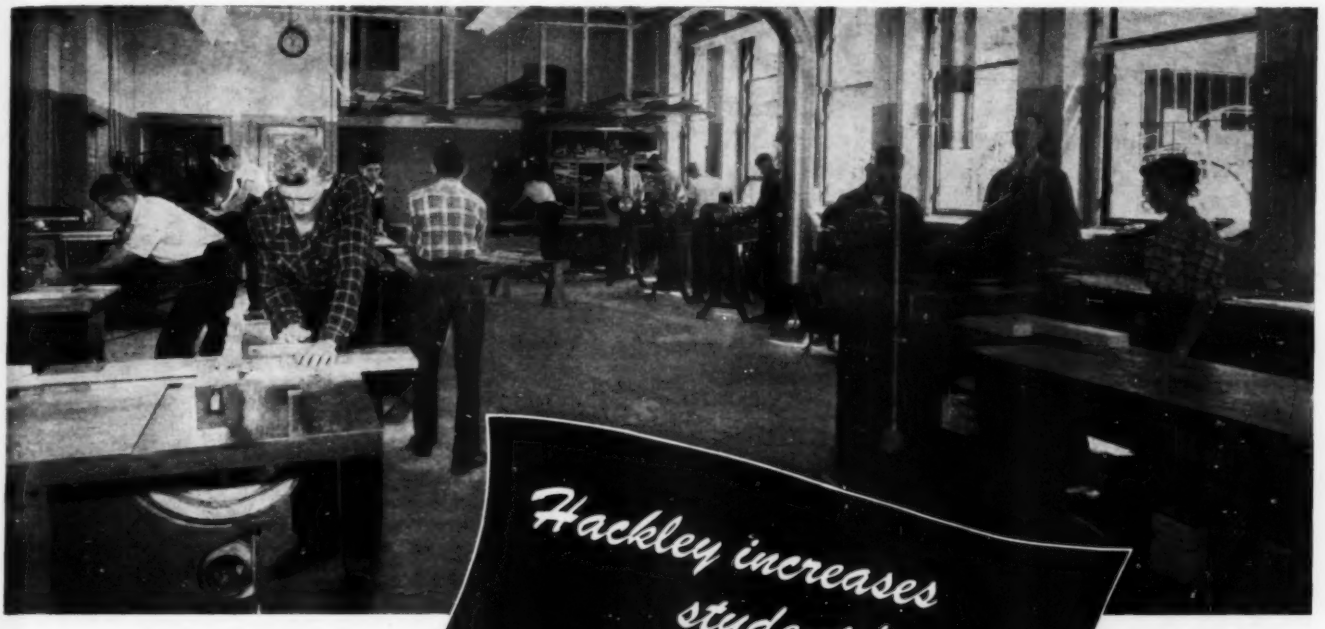
UTICA DROP FORGE & TOOL CORP.
Utica 4, New York
Sirs: Please forward free instruction material as indicated below.

☐ *Family Tree of Common Pliers Types* ☐ *Tool User's Guide*

NAME_____

SCHOOL_____
(or organization)
STREET_____

CITY_____ (ZONE)____ STATE_____



Hackley increases students' skills with "Olivers"

56 years ago Mr. C. H. Hackley founded the Hackley Manual Training School of Muskegon, Mich. From the outset good craftsmanship was stressed. To inspire students to ever higher standards in their craft, the best available woodworking machines were installed.

It was natural that the founder of the Oliver Machinery Company (established 1890) should collaborate with Hackley's director to supply its woodworking machines. Since then, relations between these two pioneer institutions have been most friendly.

Mr. Edward J. Huttenga, Hackley's present Vocational Education Director, stresses thorough woodworking instruction more than ever. Recently, after installing several new "Oliver" machines, Mr. Huttenga wrote:

"We are proud of our cabinet making shop, and have noticed an appreciable increase in the quality of workmanship. Mr. Henry V. Bolt, our instructor, is thoroughly satisfied. It produces accurate work. Its capacity and sturdy construction to endure hard usage would be difficult to replace. This equipment will benefit students for many years to come."

Hackley's students make substantial projects including cabinets, tables, etc., that embody fine craftsmanship in every detail. Surfaces are smooth; joints are perfect and strong. Hackley's experience is proof that proper training in woodworking requires sturdy, precision built machines. "Oliver" equipment also assures safety for students, and ease of operation.

The "Oliver" line of machinery for school shops includes:

Band Saws	Tool Grinders
Jig Saw	Jointers
Mortisers	Boring Machines
Shapers	Wood Trimmers
Circular Saws	Speed Lathes
Sanders	Metal Spinning Lathes
Surfacers	Electric Glue Pot

Write today for full details

OLIVER MACHINERY CO.

Since 1890 GRAND RAPIDS 2, MICH.

NOW - Plan Your School Shop on Your Desk Top

New J-Line Scale Models Provide Three-Dimensional Preview

Fred S. Darling, Supervisor of Industrial Arts, Public Schools of Beloit, Wisconsin, demonstrates value of J-Line scale models in planning a school shop.

GUESSWORK'S gone from school shop planning when you use these new models of Yates-American's popular J-Line machines. Every machine in the line is accurately reproduced — 1/2 inch to the foot — to enable you to check your projected arrangement on a similarly scaled drawing. That means you can be sure your layout will provide the greatest possible convenience, safety and space economy.

J-Line machines lend themselves to effective planning, too. The strong family resemblance in their clean, modern design will help you to make your shop look more efficient and attractive than ever before. And J-Line quality isn't just "skin-deep," either. These machines are safe, accurate, sturdy . . . ideal in every respect for use in your shop.

You can either buy these realistic models outright, or borrow them for sixty days. For complete details, fill in the attached coupon and mail it today.

YATES-AMERICAN MACHINE COMPANY
Beloit, Wisconsin

Please send me all the facts on your J-Line scale model offer.

NAME .....

SCHOOL .....

POSITION .....

ADDRESS .....

CITY ..... STATE .....

Yates-American
MACHINE COMPANY—Beloit, Wisconsin

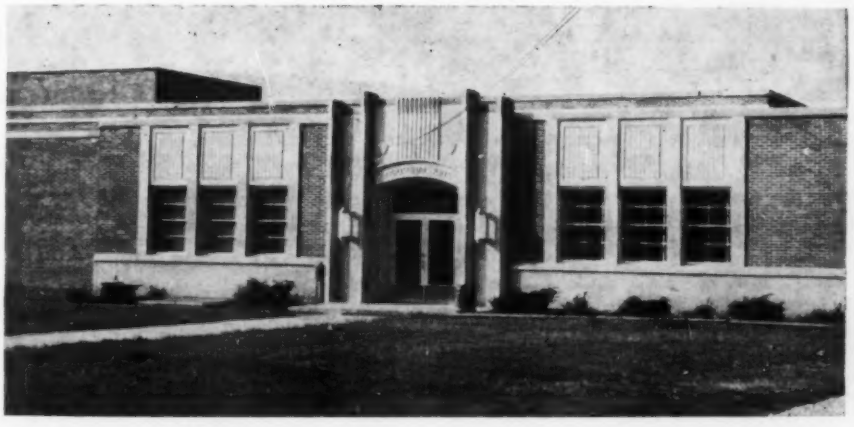
BAND SAWS • LATHES • JOINTERS • SHAPERS • SURFACERS
SANDERS • CIRCULAR SAWS • MORTISERS • KNIVES

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

MARCH 1952

The New Industrial-Arts Section at Ball State Teachers College

FRED J. SCHMIDT, JR.
Head of Department and Professor of Industrial Education
Ball State Teachers College
Muncie, Ind.



Industrial-arts section of practical-arts building

The beginning of an industrial-arts teacher training program at the Ball State Teachers College dates back to the summer of 1918 when a basement room in the administration building was equipped for drawing and shop experiences. As the department grew, added quarters were acquired, until eventually most of the available space in the basement of the administration building was devoted to some type of shop activity or classroom.

In 1929 a laboratory school was added. In this new structure was incorporated a limited general shop which functioned as such until 1939 at which time the new arts workshop became a reality and took over the housing art, home economics, and industrial arts.[1, 2]

When the Burris Laboratory School was planned, each elementary room was provided with a separate workroom equipped with tool boards, tools, and supply storage space. Benches, adjusted to various age level pupils, were also provided.

Limited plant facilities operated to hamper expansion in the college industrial-arts program offerings. To alleviate these conditions an industrial-arts section of the new practical-arts building was planned and constructed, and the building dedicated on April 21, 1950. When the business-education department and the home-economics department quarters, now under construction, are finished, the new practical-arts building will be complete. Industrial arts at Ball State Teachers College, therefore, from the kindergarten through the college program, is well housed.

The new building has been made possible through the approval and support of the college administration, the state teachers college board, the governor of the state of Indiana, the state-budget committee, and the taxpayers of Indiana. It is their belief in the worth-whileness of educational contributions through a program of manipulative experiences to the general education of boys and girls that has made the new industrial-arts section of the practical arts building possible.

A quick review of the total industrial-arts setting on the Ball State Teachers College campus has been presented for a better understanding of the problems involved in the planning and equipping of the new industrial-arts plant.

Administrators, industrial-arts staff, alumni, lay people, staffs of many teacher training institutions, and students in attendance in the department worked diligently with the capable staff of architects and engineers of "Scholer and Associates" to develop and equip a plant that would serve, in the best possible manner, in the

[1]Schmidt, Fred J., Jr., *The Evaluation of An Arts Workshop*, 2, Vol. 20, Publication 54, Dec., 1944. Ball State Teachers College, Muncie, Ind.

[2]Schmidt, Fred J., Jr., "Development, Use, and Evaluation of An Arts Workshop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Mar., 1942, p. 119.

Elementary industrial-arts shop, Ball State Teachers College

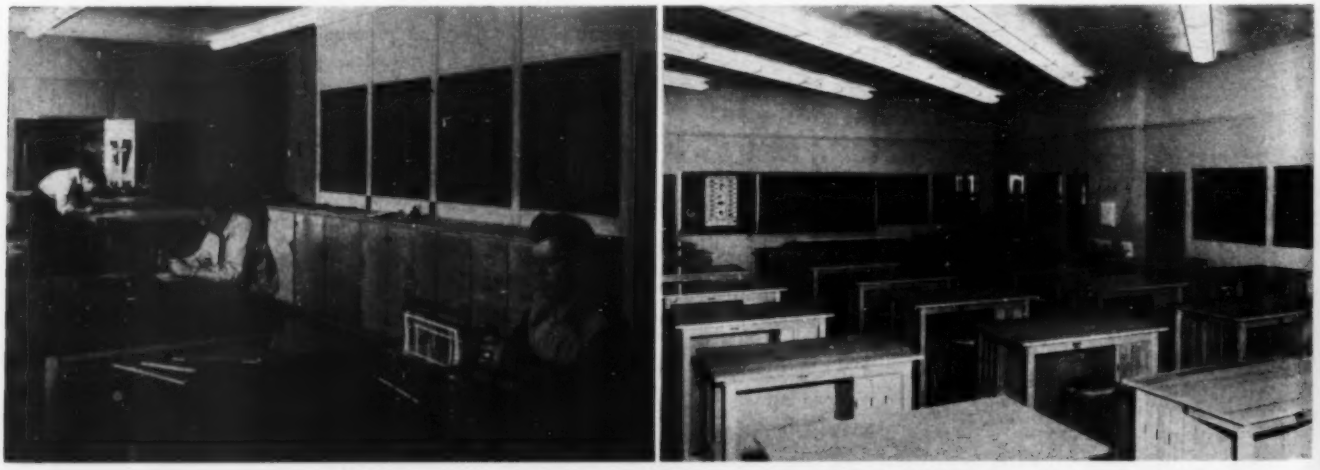
ELEMENTARY INDUSTRIAL ARTS SHOP KEYS

1. Instructor's desk; 2. filing cabinets; 2a. combination cloak and storage cabinet; 3. bookcase — planning; 3a. bookcase — large planning; 3b. magazine rack; 4. steel supply cabinet; 4a. hardware cabinets; 5. student project storage shelves; 5a. student damp cabinet — ceramics; 6. finishing supply cabinet — top shelves, bottom shelves with doors. 7. table; 7a. planning tables; 7b. ceramic tables; 7c. print-shop table; 7d. large planning room tables; 7e. finishing table; 7f. glue table; 8. sink; 9. clay storage bin; 10. storage cabinet over ceramics sink; 11. potter's wheel; 12. kiln; 13. drying shelves; 15. storage cabinet; 16. roll paper rack; 17. photography cabinet, dry; 17a. photography cabinet; 18. type stands; 20. hand press — imposing stone; 21. paper cutter; 22. storage for desk looms, yarns, and beads; 23. floor loom; 24. paper cabinet, art supplies, charcoal, India ink, crayons, etc.; 25. cabinet of drawers for student project storage; 26. leather cabinet; 26a. leather supply cabinet; 27. wood lathe; 28. jig saw; 29. jointer; 30. table saw; 31. workbench with steel lockers underneath; 32. lumber rack, vertical; 34a. folding chair truck; 35a. metal tool cabinet; 35b. wood tool cabinet; 38. foundry sand bin; 39. Keene cement and concrete table; 40. drill press; 40a. floor grinder; 41. art-metal workbench; 42. sheet and cold iron; 43. electrical bench; 43a. soldering bench; 44. woodworking bench; 45. paint cabinet, poster colors, water colors, tempera, etc.; 45a. paint supply cabinet; 46. sink under cabinet #45; 47. lapidary; 48. electric hot plate; 49. power panel for Nos. 12, 28, 20, 29, 30, 27, 40, 48, 47.

capacity of training teachers who can go forth to help meet the educational needs of boys and girls in Indiana and other state public schools.

Factors which served as guides in plant and equipment planning are:

1. State requirements for teacher certification
2. The Indiana industrial-arts curricula.
3. The Burris Laboratory School program of manipulative experiences in the elementary grades



(At left) General industrial-arts laboratory; (at right) drafting area

Woods area and related subjects room, Ball State Teachers College

OFFICE KEY

1. Combination cloak and storage; 2. double filing cabinet; 3. shelves; 4. table; 5. desk.

WOODS KEY

1. Wood lathe; 2. variety oilstone tool grinder; 3. woodworking benches; 4. combination disk and belt sander; 5. Delta jointer; 6. spindle sander; 7. band saw; 8. spindle shaper; 9. hollow chisel mortiser; 10. Delta tilting arbor saw; 11. Delta scroll saw; 12. Walker-Turner floor model drill press; 13. Oliver tilting arbor saw; 14. radial saw; 15. craftsman bench model drill press; 16. Walker-Turner bench model drill press; 17. Walker-Turner tilting arbor saw; 18. crescent jointer; 19. American jointer; 20. Oliver singe surface planer; 21. double tier lockers; 22. sink; 23. single tier lockers; 24. bulletin board; 25. chalkboard; 26. machine-shop type bench; 27. machine-shop type cabinet; 28. tool panel; 29. power control panel; 30. light control panel; 31. machine-shop type bench.

RELATED ROOM KEY

1. Storage cabinet; 2. glue bench; 3. spray booth; 4. glue assembly bench; 5. veneer press; 6. storage cabinet; 7. sink; 8. ledge-type storage cabinet; 9. storage cabinet; 10. lumber rack; 11. Foley saw filer; 12. panel stock rack.

4. The Burris Laboratory School integrated Arts-Workshop program
5. Expressed and demonstrated needs of alumni in teaching positions
6. Anticipated curriculum needs
7. The vocational aspect for teacher training
8. A demonstration center for accepted practices, new developments, and Ball State Teachers College industrial-arts philosophy
9. New and economical building construction and materials to facilitate better industrial-arts instruction.
10. Future plant and equipment expansion and growth

Floor Plan

The floor plan represents a building of approximately 31,960 square feet costing $5,000,000. At present the building houses

(At left) Woods area; (at right) metals area

from 650 to 700 industrial-arts students. These figures include approximately 400 students from the elementary teacher training program, who take courses in industrial arts for elementary grades. The building facilities will permit an extension of these figures.

The new industrial-arts section of the practical-arts building incorporates the basic philosophy of the Burris Arts Workshop which recognizes the importance of planning in laboratory experiences. The planning center[3] is, therefore, located in the center of the new industrial-arts building where it is easily accessible to all work areas.[4] Since the industrial-arts department at Ball State Teachers College offers graduate work in industrial arts, the planning center also takes on some significance as a conference and research center.

Shop areas having some relatedness adjoin one another wherever such arrangement could be provided. This is uniquely demonstrated by the foundry and heat testing area. Wood patterns are made in the woodshop, cast in the foundry, and machined in the metals area. Thus, too, electricity and transportation are placed next to metals; drawing and printing adjoin one another; the woods and the general industrial-arts laboratories have a door between their areas for easy access from one to the other.

All shops along the north side of the building, because of the nature of their work, have large overhead doors for easy access of project materials.

Classrooms and the departmental offices have been kept somewhat isolated from the shop section of the building. This eliminates shop noises and also provides easy access from the front entrance. Since the classrooms can be converted into a recreational center, easy access to the outside of the building is desirable. Each shop area has its individual office to facilitate instruction.

Washrooms, rest rooms, and showers are accessible from the hall. One hundred eighty-four individual lockers are located in the hall which runs east and west. One hundred three similar lockers are located in the shower room, thus providing a total of 278 student lockers. These provide ample storage for student wraps, and if desired, small projects.

The problem of safety was approached through the demonstrated need for such provisions as standard fire-resistant waste containers and dispensers for inflammable supplies, fire extinguishers, nonskid floor mats around power machines, application of safety color standards to power machines, proper light and engineered color schemes, and the provision of adequate floor space for passage aisles and machine-work areas.

When the practical-arts building is completed, the central hallway running north and south in the industrial-arts section, will join the central hallway of the home-economics section. An auditorium and classrooms of the business-education department and the home-economics department will also be available to the industrial-arts department.

Construction Represented in the Plant

There are current types of construction of which school people should be aware in order that buildings otherwise not possible may be erected. The type of architecture, the type of construction, and the kinds of materials used, all figure materially in the final cost of a building.

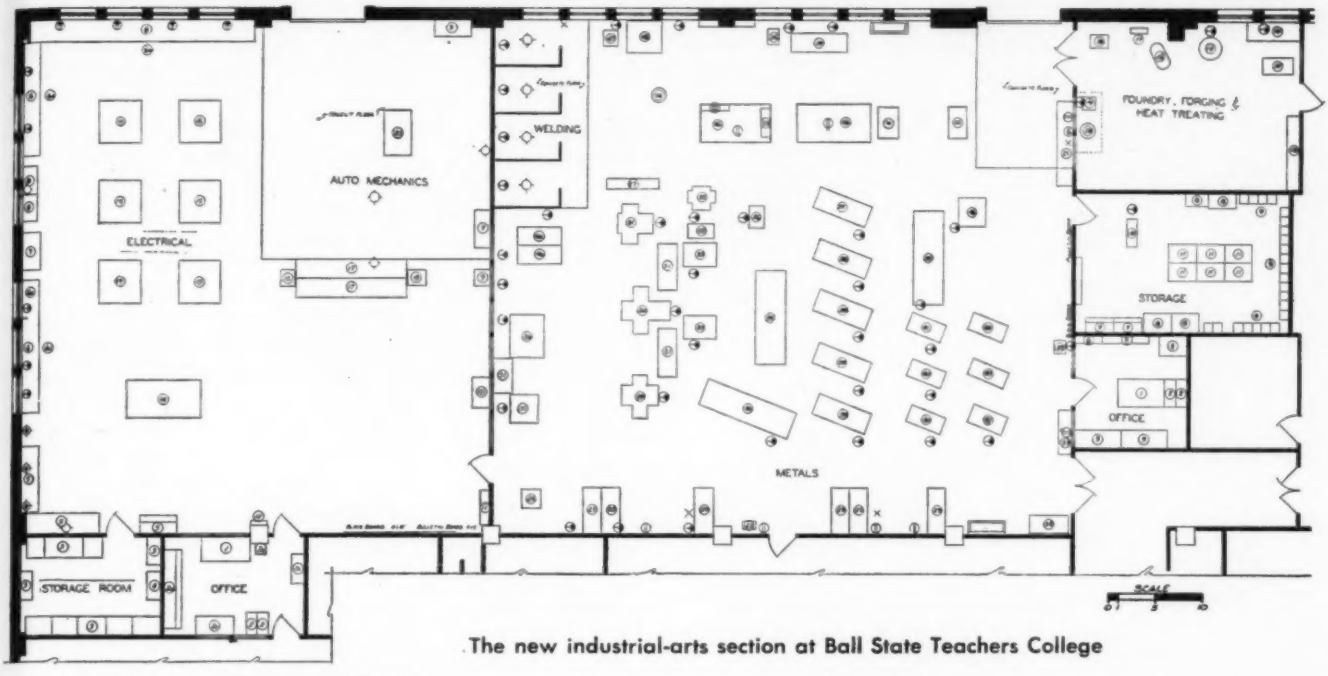
The architecture for the one-story industrial-arts section of the practical-arts building is plain. This provided for reduced labor costs in laying brick and placing stone. Being a one-story building and using steel girders, made wide shop areas available without the customary requirement of numerous concrete supporting posts scattered throughout the shop areas. There is not a post in any of the seven laboratory or shop areas. The roof is flat and therefore economical of construction.

Outside walls of the building are floating walls. Long concrete joists rest on concrete footings. These joists support the walls which are constructed of tile, faced on the exterior with brick and on the interior with glazed tile. Glazed tile walls, in shop areas, run from the floor to the ceiling. In classroom and office areas the walls are plastered.

[3]The term *center* applies to any space in the industrial-arts section of the practical arts building where a specific type of work is carried on, as the welding center, the photographic center, the finishing center, the leather center, the wood-turning center, or similar applications to other specific types of work.

[4]*Area* is the name given to a number of centers. The metals area consists of bench metals, machine metals, welding, soldering, and sheet-metal centers. The woods area consists of bench woods, machine woods, concrete and carpentry, and finishing centers.

(At left) Transportation, communication, and power area; (at right) graphic-arts area



The new industrial-arts section at Ball State Teachers College

ELECTRICAL AND AUTO MECHANICS KEY

1. Instructor's desk; 2. filing cabinet; 2a. combination cloak and storage; 2b. cabinet; 2c. typing table; 2d. control box; 3. storage cabinet; 4. storage rack; 5. battery bench; 6. electrical bench; 6a. storage cabinets under electrical bench; 7. tool cabinet; 8. soldering bench; 8a. storage cabinets under soldering bench; 9. drill press; 10. drawing table; 11. sink; 12. key cabinet; 13. acid storage; 14. wiring table; 15. workbench; 16. floor grinder; 17. auto mechanics bench; 18. band saw; 19. test panel; 20. auto lift.

METALS KEY

1. Instructor's desk; 2. filing cabinets; 3. testing bench; 4. combination cloak and storage; 5. switch control panel; 6. bookcase; 7. cabinet; 8. tool cabinet; 9. project storage cabinets; 10. power hack saw; 11. storage racks; 12. foundry benches; 13. core-maker's bench; 14. core oven; 15. melting furnace; 16. cold forge; 17. quenching tank; 18. gas forge; 19. electric heat annealing furnace; 20. pot hardening furnace; 21. soldering bench; 22. tool grinder; 23. table; 24. drafting table; 25. surface grinder; 26. universal grinder; 27. hydraulic arbor press; 28. 8-in. shaper; 29. Van Norman milling machine; 30. Cincinnati milling machine; 31. Douglas milling machine; 32. Kent Owens milling machine; 33. 16-in. shaper; 34. 18-in. Monarch lathe; 35. tool carts and layout bench; 36. drill press; 37. 12-in. LeBlond lathe; 38. 13-in. Cincinnati lathe; 39. 13-in. South Bend lathe; 40. 10-in. South Bend lathe; 41. 12-in. Sheldon lathe; 42. South Bend lathe; 43. 9-in. lathe; 44. 9-in Rivett lathe; 45. metal band saw; 46. sheet-metal benches; 47. heavy duty grinder; 48. buffer; 49. spinning lathe; 50. Brown & Sharp tool and cutter grinder; 51. South Bend benches; 52. slip-roll forming machine; 53. bar folder; 54. hand brake; 55. squaring shear; 56. sheet-metal rotary machine.

The floor for the 111-ft.-10-in. by 229-ft. shop area is laid on a 6-in. concrete slab supported by a 6-ft. gravel fill. The 12-ft. ceiling of this large shop area is an acoustical false ceiling. The entire floor and the entire ceiling were constructed before any partitions were installed. Since all partitions within the shop are metal movable partitions, constructing the entire floor as a unit and the ceiling as a unit makes it possible to move partitions at will without leaving unfinished areas in either the floor or the ceiling. Flexibility was a must in the construction of the industrial-arts section of the practical-arts building. It is felt that a building program can meet changing conditions only as its construction provides for flexibility.

Acoustically treated ceilings and wood floors together reduce much of the noise emanating from shop areas. Because of the noise-absorbing building materials and the size of the shop areas, the noise factor has been reduced to a point where shops become very pleasant quarters in which to work. In such an atmosphere instruction can conveniently be given while machines are in operation.

Hall floors are of terrazzo and therefore easily cleaned. Concrete floors are found in fire hazard centers, and where grease and finishing materials are used. Departmental offices and class areas have asphalt tile floors.

Glass has proved itself a wonderful building medium for the development of a oneness in any school plant. Students and teachers, because of it, are able to observe activity in adjoining areas. Visitors are, because of the extensive use of glass, able to observe work in all areas without entering the laboratories or shops. There is much evidence to support the hypothesis that glass partitions help to raise the morale of the group housed in such a plant. Students and staff at Ball State Teachers College react favorably toward the use of much glass in both hall and area partitions.

Storage

All storage space in the industrial-arts section of the new practical-arts building serves a specific need. Commercial storage equipment was carefully studied. When usable standardized cabinets and storage facilities were purchased, building costs were reduced. Where commercial cabinets and storage facilities did not fit the specific need, the cabinets were designed and specially constructed for the job. Thus the new building contains much specially designed equipment. The general industrial-arts laboratory is completely equipped with this type of storage cabinets. The drafting rooms likewise are equipped with drafting benches designed to meet a specific need. Tool boards in all but one area were so designed and constructed. Lumber and metal racks were likewise designed. Unique tool carts were designed, placed on casters, and are housed under long work benches designed for this purpose.[5] In a large number of instances commercial stock items were remodeled. Large quantities of steel storage cabinets of various descriptions were used.

[5]Yoho, Lewis W., "Tool Accessory Cart Useful in Metals Shops," *School Shop*, Oct., 1951, p. 24.

Show Cases

Two large movable show cases are located in the halls. The interiors are so designed that they may be easily rearranged for a variety of displays. They are used to display student work or industrial products. A program for displays is carefully planned in order that a stimulus for better work may accrue.

Services

Fluorescent light, in adequate amounts, is available throughout the entire building. Since there are definite utility, psychological, and aesthetic relationships between light and color, the three were engineered together. Color in this instance has reference to color of walls, ceilings, floors, cabinets, furniture, and machines. Because light and color were thus treated, the atmosphere in the entire building is most agreeable. It is highly probable that shops, where light and color are harmonized, are conducive to more efficient work because of the more pleasing atmosphere.

Venetian blinds throughout the entire building aid in the control and distribution of natural light.

The ventilating and heat plants are one. Fresh air is drawn through oil filters, over heated radiators, and delivered to the various areas of the building by ducts located in the attic. The ventilating and heating units are housed in a penthouse located on the roof over the center of the building. In this same penthouse are located the dust collecting system and the compressed air system.

Dust is collected from the woods area and the general-arts laboratory. All pipes leading to machines are located under the floor, thus avoiding, as much as possible, interference with the general appearance of the woods area. Floor sweeps are also provided for excess dust and shavings not caught by machine contacts. The blower for this unit is located in the penthouse. The separator and dust bin are mounted on the outside of the building.

Compressed air is delivered to all shop areas for use by various pieces of equipment needing this type of power. Enough outlets are available so that a 50-ft. snap-on hose, for cleaning purposes, will reach all parts of the shops. Compressed air is also available at the electrical benches and for the spray booth.

Fumes from the transportation center, from the welding booths, from the heat-treating centers, the soldering benches, the foundry center, and the spray booth are all expelled through specially constructed flues and exhausts meeting specifications of the Fire Code.

Power consists of 120/208 voltage current. In the electrical areas it is also reduced below both of the named voltages. Power reaches the building through a service tunnel. It is conducted to oil-cooled transformers which deliver 120/208, 3-phase, secondary voltage to power panels which control the distribution of electrical current through the building. Transformers and power panel are housed in a power room which is located under the departmental offices and classrooms. The power is conveyed through a conduit and underfloor duct system laid in the concrete slab under the wood floors. These conduits and ducts are spaced at 10-ft. intervals and may be tapped every 2 ft. for outlets. This provides a rather flexible arrangement for the shifting of old or the addition of new machines. An adequate number of outlets are found in all work areas.

Power panels for each shop area are located in their respective area offices. Each machine in the area has its separate switch in the office power panel and a start and stop switch on the individual machine.

Plenty of sinks and bubbler fountains have been supplied in all work centers. Water outlets are also available at convenient spots on the outside of the building.

Floor drains in such areas as concrete, ceramics, and transportation, contain special traps to facilitate cleaning.

Gas is found in such areas as graphic arts, electricity, transportation, metals, foundry, and the general industrial-arts laboratory.

Equipment

Equipment in the industrial-arts section of the practical-arts building cost approximately $224,000. Although the factor of maintenance many times decides the kind of equipment that is purchased, the guiding principle accepted for the selection of equipment in the industrial-arts shops of the new practical-arts building was that of variety or spread. Just as a wide variety of activities are required to make up an adequately functioning general shop, so it requires that industrial-arts teachers in training should have experience with a large variety of machines and hand tools. Added to the list of machines and hand tools in use in public school shops are also those which the staff felt needed to be represented and their use encouraged.

Various machine color schemes were developed for the different shop areas in order that again teachers-in-training as well as teachers-in-service, and administrators, might observe the different effects of different machine color patterns.

Areas — Offices

There are a number of workable plans for efficient and agreeable housing of office space in a department such as industrial arts. After carefully considering the pros and cons relative to various office arrangements, the staff decided upon a departmental office and upon individual staff offices located in each of the shop areas.

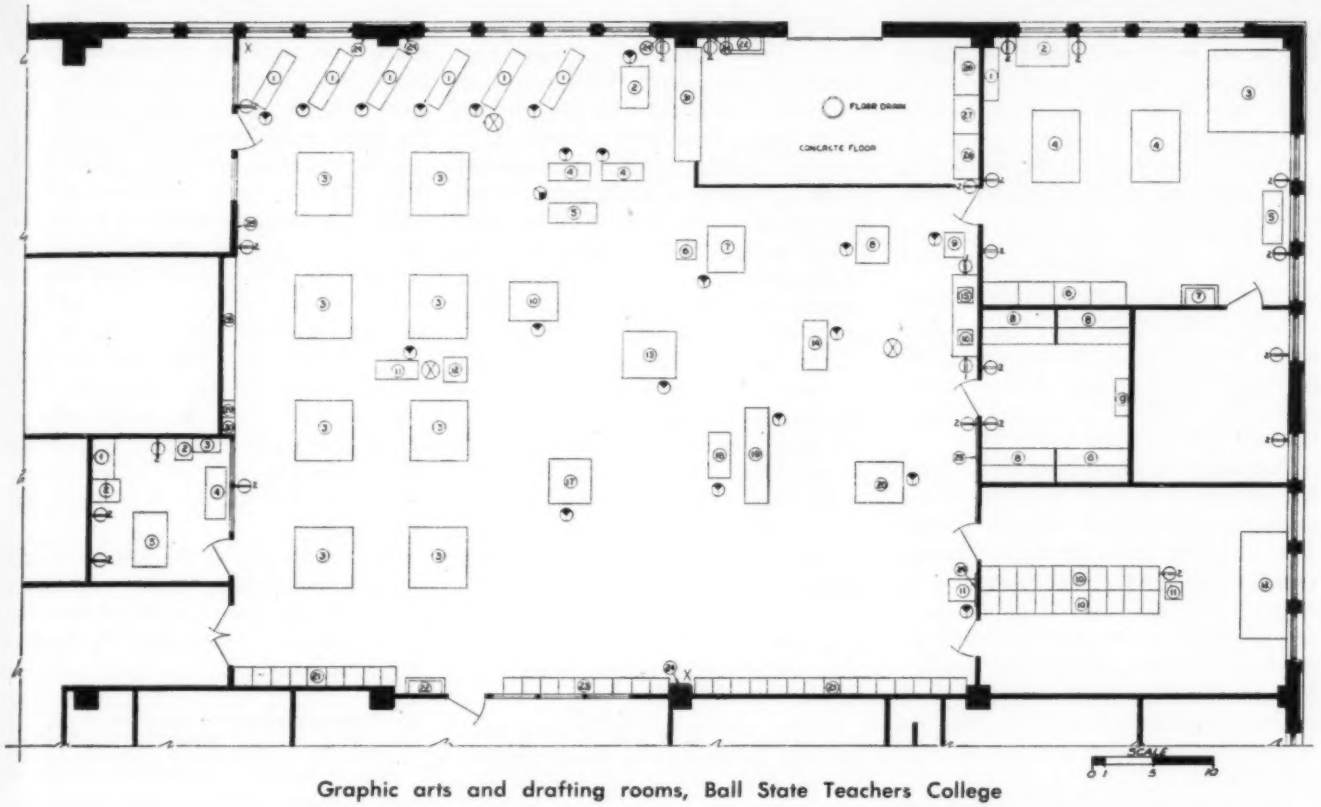
The departmental-office suite, 720 square feet, consists of a reception room, two work storage rooms, and an office for the head of the department. These offices and workrooms are equipped with adequate filing space, bookcases, storage cabinets, washrooms, a ditto machine, typewriters, adding machine, and an audograph unit.

Staff offices are located near the entrances of the shop areas. These offices average 120 sq. ft. Glass partitions, in offices, assist in the supervision of shop areas. Each office is equipped with a desk, an office chair, a conference table and chairs, two filing cabinets, a bookcase, and a combination coat and storage cabinet. In all but one case the staff office contains a power panel which controls the use of all machines in the area. Experience with staff offices in shop areas substantiates the belief that instruction is easier and more efficient because of their provision.

Planning Center

The planning center, 627 sq. ft., is located, as a hub, in the center of the building, thus allowing for easy access by students and staff from all parts of the building. It is equipped with tables, chairs, book and magazine cases, a cabinet for rolls of wrapping paper, blackboard and bulletin board, and a lounging center equipped with overstuffed chairs and reading lamps. General reading, project research and planning, and graduate research constitute the principal activities of this area.

Although glass partitions make up one side and an end of the planning center, projection of even color is possible with no other preparation than that of turning out the lights in the planning center. The setting is unique in that as projection



Graphic arts and drafting rooms, Ball State Teachers College

GRAPHIC ARTS KEY

1. Darkroom cabinet and sink; 2. contact printer; 3. paper cutter table; 4. scrap paper truck; 5. power paper cutter; 6. storage cabinet; 7. double storage cabinet; 8. vacuum printing frame; 9. bulletin board; 10. offset copy camera; 11. whirler; 12. developing trough; 13. sink; 14. multilith; 15. cabinet; 16. plate filing cabinet; 17. paper folder; 18. pressroom cabinet; 19. little giant press 12 by 18; 20. offset cabinet; 21. production desk; 22. offset 17 by 22; 23. rubbing-up table; 24. storage cabinet; 25. arc lamps; 26. student storage locker; 27. cabinet; 28. desk; 29. book shelves; 30. filing cabinet; 31. storage cabinet; 32. table; 33. paper drill; 34. worktable; 35. layout table; 36. portable table; 37. miter; 38. saw; 39. plate press 8 by 12; 40. plate press 10 by 15; 41. platen press 12 by 18; 42. galley storage; 43. Virkotype; 44. proof press; 45. perforator; 46. stitcher; 47. table; 48. bookbinding table; 49. jobber book press; 50. planning tables; 51. imposing stone; 52. metal furniture cabinet; 53. 2-pilot lever presses; 54. rubber stamp bench; 55. chalkboard; 56. vari-typer table; 57. cabinet; 58. type cabinets; 59. hand stone storage; 60. stainless steel drainboard; 61. silk screen tables; 62. storage cabinet; 63. movable cart.

DRAFTING KEY

1. Dietzgen blueprint machine; 2. sink; 3. vertical storage cabinet; 4. layout table; 5. instrument storage; 6. tilt-top drawing table; 7. combination table and bench; 8. metal drawing table; 9 sink; 10. copy table; 11. bulletin board; 12. drawing tables; 13. drawing tables; 14. display case; 15. instructor's desk; 16. chalkboard; 17. cloak and storage; 18. bookshelf; 19. filing cabinet; 20. table; 21. desk; 22. lie-flat file; 23. drawing tables.

within the planning center proceeds, students and visitors passing through the hall will stop to view the pictures. Thus again there is demonstrated a situation where vicarious learning is encouraged because of plant construction. Both 120-*v* and 208-*v* current are provided so that equipment may be demonstrated in the planning center. The room may also be used as a display center for large projects or industrial exhibits.

Classrooms

Two classrooms, separated by a movable partition have been provided. This 1452 sq. ft. area permits accommodation of groups up to 150. One of the classroom areas is provided with standard armchairs. The other has tables and folding chairs which provide for seminar and conference settings. Both rooms are equipped with green chalk boards, bulletin boards, and dark shades.

A small adjoining room containing a kitchenette unit consisting of an electric stove, oven, refrigerator, and sink; storage cupboards stocked with stainless steel cooking utensils; and plastic dishes, aluminum water glasses, and silverware to accommodate one hundred individuals; make the double classroom unit a very workable recreational center.

These classrooms are also equipped with portable projection equipment consisting of a 16mm. film projector, a 2¼ by 2¼-in. slide projector, an 8¼ by 9¼-in. opaque projector, screens, and a movable stand.

General Industrial-Arts Laboratory

The general industrial-arts laboratory (general shop) is so versatile in its adaptation to industrial-arts needs that there is little wonder it is in constant use. It serves as a laboratory for industrial-arts orientation courses, crafts courses, and recreational activities. It also provides for courses in industrial arts for elementary grades which are required by all elementary teachers enrolled on the Ball State Teachers College campus, and is used by graduate students in courses in industrial arts for elementary grades.

Activities provided for in this laboratory are planning, ceramics, textiles, leather, photography, printing, hand and machine woods, bench and machine metals, foundry, art metal, electricity, lapidary, finishing, and cement work. There are 4877 sq. ft. of floor space in the general industrial-arts laboratory including the planning center, printing center, ceramics center, finishing center, darkroom, and storage rooms.

Power machines are of the type found in the smaller township school shops, namely grinders, drill press, jig saws, table saw, jointer, metal lathe, shaper, power hack saw, and mill. Services such as water, gas, power, and compressed air are adequately provided.

Extensive glass areas in the hall partition and in the partition between the general industrial-arts laboratory and the woodshop make observation of work in both areas possible.

Glass in two walls of the instructor's office makes the entire laboratory visible from this station.

Drafting

The drafting area consists of two rooms occupying a combined floor area of 2750 sq. ft. These rooms are equipped to do beginning drawing which consists largely of freehand drawing, architectural drawing, and industrial-arts design.

Beginning drawing is taught in room number 138. The room is equipped with thirty specially designed drawing benches. Each bench contains six bins. Each bin contains the drawing equipment used by students in beginning classes. A large drawing bench is also provided for the instructor. Adequate chalk boards and bulletin boards are available in this area. A project storage cabinet set in the partition between the two drawing rooms is accessible to both.

The second drawing room, number 139, is also equipped with chalk boards, bulletin boards, a tracing table, a B & W printer, and an equipment storage cabinet which is set into the wall of a large storage room. This drafting room is unique in that it is furnished with a variety of different kinds of drafting tables used in various school drafting situations. The large drafting tables are equipped with drafting machines. It was thought that a room thus equipped, would assist teachers and administrators in their selection of appropriate drafting equipment and cabinets.

Fluorescent lighting in both of the drafting rooms is diagonally installed so as to prevent shadows from pencils and drawing instruments.

Large areas of glass have been provided in the partitions of the drafting rooms. Again, as in other areas, this provides for a unification of a program difficult to accomplish by other means.

Woods

In the woods area are taught hand woodwork, machine woodwork, patternmaking, finishing, and concrete and carpentry. Machines such as wood lathes, table saws, surfacers, jointers, sanders, band saw, mortising machine, shaper, power sanders, Foley Saw Filer, drill presses, jig saws, and a radial saw make up the power equipment of the woods area. The finishing room contains a completely equipped spray booth with explosion-proof light fixtures and switches. Tool boards, supply cabinets, and supply rooms are adequately supplied. Lumber is stored in horizontal and vertical racks. Plywood is stored on shelves specially designed for this purpose. An adequate number of project storage cabinets are available. This shop with its service areas occupies 4895 sq. ft.

Large open floor spaces are available in the woods area in which large furniture and carpentry projects may be assembled.

A unique feature of the woods area is the use made of the overhead door space in the north wall. Just inside of the door is a 312 sq. ft. concrete slab upon which concrete work is done in inclement weather. When weather permits, however, the concrete work may be moved outside to a large concrete slab which contains aggregate bins built by the concrete and carpentry classes.

Another unique feature is the foundry adjoining the woods area for easy correlation of patternmaking and foundry practices.

Foundry

This area provides for experiences in foundry work, forge work, and various types of heat-treating. Adequate flue and hooded areas are provided so that detrimental fumes and gases may be easily eliminated. Power, gas, and air are provided for the equipment in this area. The foundry occupies 444 sq. ft.

Metals

The metals area occupies a floor space of 3981 sq. ft. In it are taught courses in bench metal, sheet metal, and machine metal. Acetylene, and a.c. and d.c. electric welding are also provided for in specially designed metal, ventilated booths.

Much care was practiced in equipping this area to be certain that as many representative makes of basic metal machines, as possible, would be available to students preparing for teaching in order that the students might become familiar with equipment on which they would later teach.

Machines found in the metals shops are drill presses, grinders, lathes, shapers, mills, a metal-cutting band saw, internal and external grinders, buffers, welding machines, presses, a metal spinning lathe, and a complete unit of sheet-metal equipment.

Tool boards, bulletin boards, student storage, and supply storage are adequately provided for in this area. A unique feature of the metals area is the provision for the machine tool storage.[6] Each machine has its individual cart which contains all basic tools for the particular machine to which it is assigned. When not in use the carts are stored under special workbenches provided for this purpose. These benches and carts both appear in the halftone showing the metal area. The metal area is supplied with an outside, overhead door.

The relationship, too, between the foundry, the woods, and the metals areas is unique. Castings from patterns made in the woods area can be made in the foundry and then taken to the metals area for machining.

The relationship of the metals area to drafting for planning purposes, and to electricity and transportation for related project purposes, offers possibilities for integration of area content.

Transportation, Communication, and Power

Since there are differences in points of view regarding what types of experiences should go to make up offerings in transportation, communication, and power, this area was set up as an experimental situation with just enough equipment to provide for such experimentation. If and when a workable program is arrived at or agreed upon, equipment to further such program will be added.

At present the area, 3146 sq. ft., is equipped with much bench space. Hand tools for electricity, auto mechanics, and aviation are available. Floor stands and lifts for mounting and moving engines of various types are provided. A considerable number of testing devices have been provided.

Drill presses, grinders, a combination wood and metal cutting band saw, and a metal lathe make up the list of power machines. Several woodworking machines are to be added.

Fume exhausts are provided in floor ducts to carry off gases when gas engines are in operation.

An overhead door and a concrete floor slab make indoor space available for work on various power units.

Large open floor spaces make the area flexible so that changes in equipment ar-

[6]Yoho, Lewis W., "Tool Accessory Carts Useful in Metals Shops," *School Shop*, Oct., 1951, p. 24

rangement can readily be made to meet changing needs.

Large surfaces of glass in the partition between this area and the metals area help to provide vicarious learning so essential to an expanded interest in many shop experiences.

Graphic Arts

The graphic-arts area, 2922 sq. ft., provides a rich offering of graphic-arts experiences such as block printing, silk screen, book binding, rubber stamp making, hand setting and composition of type, and offset printing. Various forms of machine operation include hand presses, platen presses, bed press, multigraph, offset equipment adequate for the making of offset plates, an offset press, a Vari-Typer, a Virkotype, proof presses, perforator, saws, stitcher, paper drill, a power paper cutter, and a folding machine. Type cases house many well-designed type faces.

Cabinets and a store room provide adequate storage space. The darkroom, into which is built the offset camera, is provided with equipment to do the necessary operations in photography.

The regular classwork plus job work for the college are carried on in the graphic-arts area.

Summary

It has been the purpose of those responsible for planning and equipping the industrial-arts section of the new practical-arts building to provide as safe and pleasing an environment for work as present materials and know-how could provide. It also was the purpose to provide for as rich an experience as possible in the field of industrial arts so that teachers in training would be adequately prepared in philosophy, knowledge, skills, and appreciations. And finally, it was the purpose to bring together in one plant as many types and makes of equipment as possible to assist students in acquiring a broad experience and acquaintance with equipment and materials, thereby demonstrating to administrators and teachers actual desirable shop situations from which they might get ideas for better and more embracing industrial-arts curriculums, buildings, and equipment, of the industrial-arts shops in the public schools. It is the hope of the administration and the staff that these purposes may continue to be fulfilled.

Industrial Arts at Wisconsin State College, Platteville, Wis.

HARRY A. PEDERSON
Director of the Industrial Arts Division
Wisconsin State College
Platteville, Wis.

The industrial arts division at the Wisconsin State College, Platteville, is housed in a separate building constructed of steel, concrete, tile, and brick. This building was completed in 1942 and consists of two floors devoted to industrial-arts and allied activities. The dimensions of the building are 164 by 76 ft. with approximately 25,000 sq. ft. of floor space.

Industrial arts made its first appearance at this college in 1902 in connection with the training school. In 1908 the industrial-arts department was founded and was authorized to train teachers of manual training. During the early years the industrial-arts courses were of two and three years' duration. In 1916 the industrial-arts division was organized and in 1927 the college was given the power to grant degrees to students completing the four-year course in industrial arts. At the present time Wisconsin State College at Platteville is a member of the American Association of Colleges for Teacher Education, North Central Association of Colleges and Secondary Schools, and National Commission on Accreditation. It is the only state college authorized to grant degrees in industrial-arts education. The average number of students majoring in industrial arts is one hundred and from twenty to twenty-five are graduated yearly. Graduates of this division are teaching in various types and sizes of schools in Wisconsin and in many other states of the Union.

Prior to the completion of the new building in 1942 the industrial-arts work was done in small quarters in the main building. During the years of World War II progress, understandably, came to a virtual standstill. Little could be done toward furnishing the new building adequately with equipment, furniture, supplies, machines, and accessories. The ending of the war and the returning of the veterans in 1946 initiated a rapid program of development which is continuing at the present time.

In all the years prior to 1946 only one man conducted the industrial-arts work. In 1946 the staff was increased by one and in 1947 the staff was increased to four men who devote full time to carrying on the work of the division. The industrial-arts building is now equipped and furnished in a manner that makes it possible to train men to go out and do modern and professional industrial-arts teaching.

The Woodshop

The woodshop, located on the first floor, has a working area of 77 by 36 ft. and contains approximately 2765 sq. ft. of area exclusive of finishing room, project room, and lumber room. The shop is adequately equipped with machinery and accessories, hand tools, and benches. Necessary auxiliary rooms are equipped with the essential racks, cabinets, and benches needed for efficient work. In addition to the materials needed for hand finishing the finishing room is equipped with a spray

(Above) Industrial-arts division building; (lower) the print shop

booth and blower and modern spray guns.

Attention was given to color in the woodshop. Pastel green brightens the upper walls and ceiling while the lower walls have a darker tint of green. All the machinery is painted green with dangerous parts highlighted in red. Tool cabinets and tools are painted in attractive identification colors. Color, together with colorful bulletin and display boards make the shop attractive and accounts, in part, for its heavy use by students in unscheduled hours.

Five courses are offered in the woodshop. Three of these are required of all industrial-arts majors. Each of the five courses is best described as of a limited general shop nature. Intensive experience is given in handwork and techniques, carving, intarsia, marquetry, and other decorative work with wood. Thorough instruction is given in phases of machine operation and technique as well as in the adjustment and repair of machines and the upkeep of knives, cutters, and blades. Since an expertly made article of wood can be ruined by poor finishing great stress is placed on different finishes and the techniques for applying them properly. Training is given in the application of older type finishes such as shellac, varnish, paint, enamel, and oil as well as the newer types of lacquers, oils, paints, waxes, stains, etc.

Industrial arts and crafts work also is taught in the woodshop to majors in industrial arts, rural education, and elementary education. Seventh- and eighth-grade training school students also receive industrial-arts experience in the woodshop. Upon completion of a new general shop in 1952 the craft and training school work will be moved there. This transfer will make the woodshop even more useful.

The Metal Shop

This large well-lighted shop is located on the second floor, has a working area of 36 by 160 ft., and contains approximately 5760 sq. ft. exclusive of storage rooms. The great length of the room permits two unit shop classes or a unit shop class and a limited general shop class to function simultaneously. The area is adequately equipped with machinery and accessories, hand tools, and benches. The ample storage areas are equipped with the necessary racks, cabinets, and benches for the storing of instructional supplies.

Attention was given to the value of color in this shop also. The machines, benches, cabinets, and tools of the various areas, such as welding, sheet metal, machine shop, and the like are painted in distinguishing colors. The concrete ceiling and three walls are painted a rich white. The remaining wall is constructed of tile and its pleasing tones of cream and brown are left untouched.

In the metal shop, work is offered in gas and arc welding, elementary and advanced machine shop, elementary and advanced sheet metal, elementary and advanced art metal, general metal, plastics, and the diagnostic and testing phase of auto mechanics. Plastics and art metal will be moved from the metal shop to the new general shop when it is ready in 1952 or early in 1953. When this shift is accomplished some rearranging will be done in the metal shop and an area set aside and equipped for a course in basic electricity. This shift will also permit planned expansion of the machine shop and general metals area.

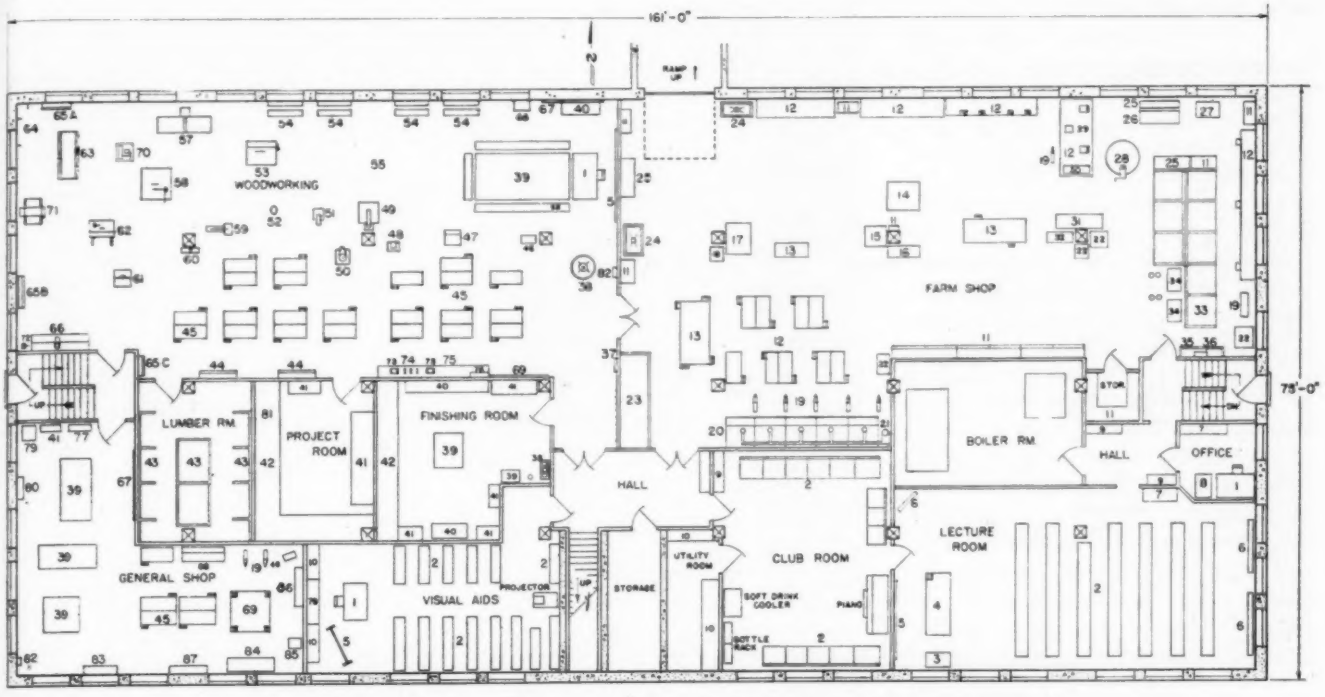
The Graphic-Arts Laboratory

This is one of the busiest and most attractive shops of the division. Not only does this laboratory give training to industrial-arts majors in graphic-arts techniques, but it also serves the division and the college by doing signs, posters, tickets, programs, and tags for committees and clubs. In this manner most of the printing and graphic-arts work is made functional. Techniques and processes are learned and the product is put to practical use which makes the work realistic and stimulating for the student.

In this laboratory instruction is given in platen press work, offset printing, silk screening, air brush technique, linoleum block processes, dry point etching, bookbinding, and mimeographing. The purchase of a camera and the making of process plates will soon become a part of the work. The shop is 46 by 32 ft. and contains 1475 sq. ft. of area, exclusive of storage facilities.

The Drafting Room

"The world moves over the drawing board" attests to the fact that drawing is a universal language and that it must be a strong part of an industrial-arts teacher training program. The drafting room is on the second floor in a quiet section of the building. Its size is 46 by 32 ft. which



Industrial-arts division, Wisconsin State College at Platteville. First floor plan

PARTIAL LIST OF EQUIPMENT FOR FIRST FLOOR

1. Desk and chair; 2. armchairs; 3. table; 4. bench; 5. blackboard; 6. display board; 7. bookcase; 8. filing cabinet; 9. lockers; 10. utility cabinet; 11. tool cabinet; 12. workbench; 13. portable workbench; 14. 10-in. circular saw; 15. band saw; 16. 8-in. jointer; 17. radial saw; 18. buffalo shear; 19. anvil; 20. charcoal forge; 21. exhaust blower; 22. grinder; 23. wood storage rack; 24. sink; 25. scrap container; 26. squaring shear; 27. bar folder; 28. sheet-metal table; 29. gas furnaces; 30. slip-forming rolls; 31. power hack saw; 32. drill press; 33. arc welding; 34. oxy-acetylene station; 35. sheet-metal rack; 36. electric switch boxes; 37. electric switch panel; 38. wash sink; 39. planning table; 40. counter and storage; 41. storage cabinet; 42. open shelf storage; 43. wood storage rack; 44. hand tool cabinet; 45. woodworking bench; 46. buffer; 47. mortise; 48. disk sander; 49. large band saw; 50. drill press; 51. small band saw; 52. spindle sander; 53. 12-in. rip saw; 54. turning lathe and tool cabinet; 55. assembling area; 56. bench seat; 57. 16-in. jointer; 58. 14-in. cross-cut saw; 59. jig saw; 60. 6-in. jointer; 61. spindle shaper; 62. 8-in. circular saw; 63. glue and clamp bench; 64. clamp rack; 65A. routers and parts; 65B. spindle shaper parts; 65C. circular saw blades; 66. radial saw; 67. bulletin and blackboard; 68. paper roll; 69. metalworking bench; 70. multiple sander table; 71. 24-in. planer; 72. trimmer; 73. tool grinder; 74. wet stones; 75. nail drawers; 76. saw-filing tools; 77. project planning cabinet; 78. movie screen; 79. filing cabinet; 80. drawing equipment and cabinet; 81. short stock storage; 82. first aid cabinet; 83. leathercraft tools; 84. hardware cabinet; 85. screw cabinet; 86. metalworking tools; 87. hand woodworking tools; 88. finishing supplies; 14-in. Delta table saw (not on drawing).

gives it approximately 1475 sq. ft. of area, exclusive of storage space. Adequate drawing space is provided for 32 students. Cabinets for models, drawing boards, and paper and special drafting equipment are conveniently located. Two large drafting tables are equipped with Universal drafting machines. A small room houses necessary equipment for duplicating drawings.

Five drafting courses are required of industrial-arts majors. The courses are freehand sketching, mechanical drawing, machine drawing, and two courses in achitectural drawing. Blueprint reading is a part of all the drawing courses and every effort is made to make each course functional. Freehand sketching in black and white and color is the first course in drawing taken by the students. Upon completion of the course each student can make accurate freehand sketches and do some remarkably fine work. In the instrument courses which follow, a certain amount of freehand sketching is required because it is believed that the ability to do freehand sketching is one of the most useful techniques an industrial-arts teacher can possess.

In the fall of 1952 a course in industrial-arts design is to be added to the curriculum. Since it is to be a course in the theory of good design as well as in the application of design principles to projects in various mediums, it will be taught in the drafting department.

The "Model" Shop

The shop designated as the General Shop is a multi-purpose area. One of its functions is to serve as a shop for industrial arts and crafts which majors in rural and elementary education take as a part of their work. Fifth-, sixth-, seventh-, and eighth-grade training school students also experience a variety of craft work in this shop at different periods throughout the week. Sometimes the classes in the adjoining woodshop are too large and in this event some of the students do some of their work in the general shop.

Around the Platteville area there are many small high schools that do not have industrial-arts work in their curriculum. Some administrators believe that the establishment of an industrial-arts department is a costly affair requiring large rooms and expensive equipment. We all know that this can be true. However, we in the industrial-arts division believe that a small start is better than none. Therefore, the general shop is located in a small room and purposely modestly equipped with tools and machines. Many of the benches and cabinets are made over from discarded material. School officials who visit the shop can see what fine industrial-arts work can really be done with a modest outlay for tools and equipment and in a space they probably could provide in their respective schools.

General Shop Laboratory

In 1952 or 1953 the lecture room on the first floor is to be converted into a general-shop laboratory. Senior students in the current equipment and management class have

Industrial-arts division, Wisconsin State College at Platteville. Second floor plan

PARTIAL LIST OF EQUIPMENT FOR SECOND FLOOR

1. Display table; 2. equipment case; 3. student equipment storage; 4. drawing tables and benches; 5. darkroom; 6. welding tables; 7. portable oxyacetylene equipment; 8. blower system; 9. arc welding booths; 10. oxyacetylene tank storage room; 11. wood lathe for spinning; 12. soldering bench with oven; 13. squaring shears; 14. buffing wheel (plastics); 15. buffing wheel (art metal); 16. sheet-metal rack; 17. jig saw (metal or plastics); 18. pan break; 19. sheet-metal benches, equipped with forming machines, etc.; 20. sun testing equipment; 21. Allen tester; 22 milling machines; 23. shapers; 24. drill presses; 25. tool grinder; 26. power hack saw; 27. surface grinder; 28. 16-in. lathe; 29. 9-in. lathes; 30. Brinnel hardness tester; 31. arbor presses; 32. type banks and cases; 33. stapler; 34. proof press and imposing stone; 35. imposing stone; 36. platen presses; 37. rule and furniture cabinet; 38. Davidson dual press; 39. metal saw; 40. paper cutter; 41. storage cabinet — forms, cuts, and engravings; 42. galley storage; 43. general storage — slugs and leads; 44. silk-screening bench; 45. paint storage; 46. production press (offset); 47. drying racks; 48. workbenches; 49. workbenches with metal vises; 50. planning tables; 51. planning desks; 52. filing cabinets; 53. bulletin boards; 54. tool cabinets; 55. instructors' desks; 56. miscellaneous; 57. lockers; 58. scrap disposal (metal); 59. drawing tables; 60. clothes rack; 61. wash sinks.

as their problem the planning of this shop down to the smallest detail. They will make complete specifications for every item that will go into the shop. This shop is to be arranged in a manner that will make it possible to teach unit shop classes as well as composite shop classes.

One of the unit-shop classes which will be taught here is plastics, which is now being offered in the general-metals laboratory. Another unit-shop course to be given here is art metal, now also being taught in the general-metals laboratory. Moving plastics and art metal to the new shop will make room in the metals laboratory for a course in electricity, that is going to be offered beginning in 1952. The electrical course is to be required and will call for a prerequisite in physics and will remove a deficiency in the offerings of the industrial-arts division.

In addition to the unit courses in plastics and art metal the new shop will be equipped and planned to handle training school classes of a general-shop nature as well as craft classes. Two industrial-arts and crafts courses will be taught. One is for majors in rural and elementary education. Another craft course is for industrial-arts majors. Both are of a general-shop nature consisting of leatherwork, wood craft, metal craft, sketching and designing, and other crafts.

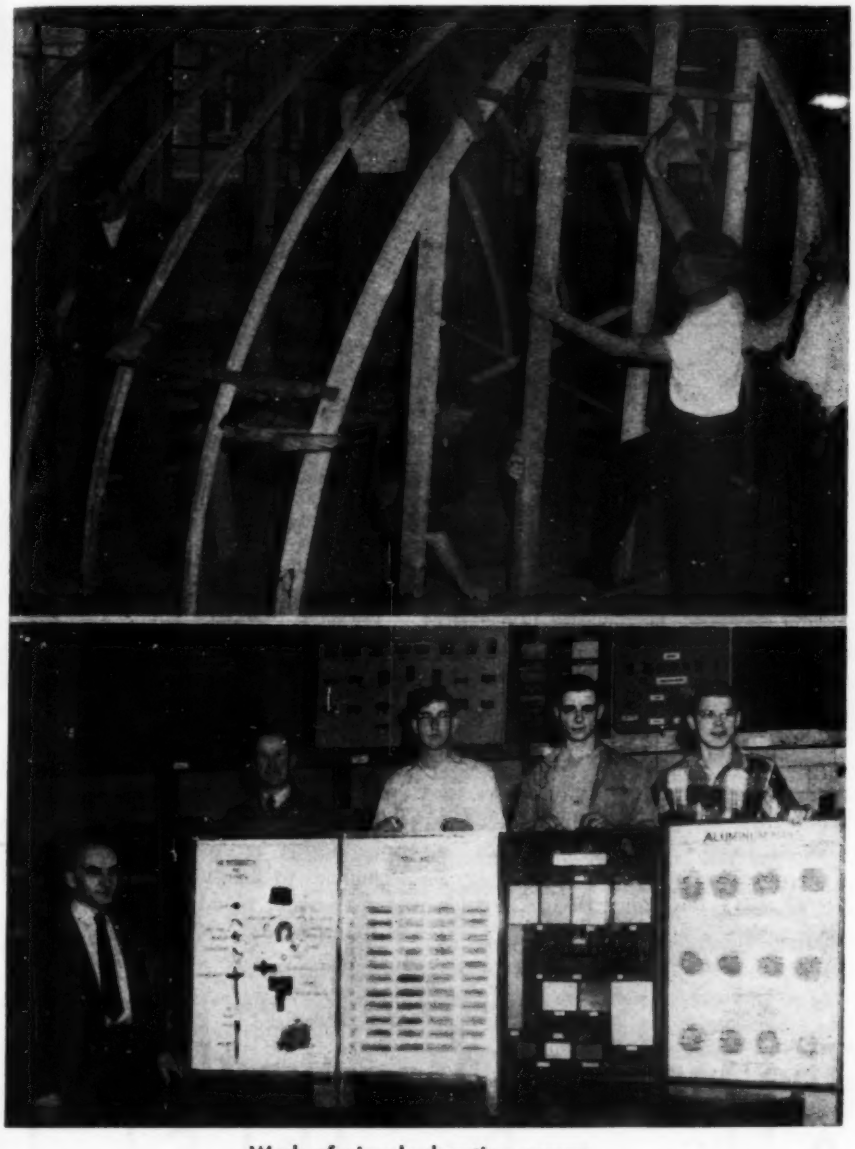
Visual Aids Room

An important feature of the industrial-arts building is the visual aids room. Although somewhat small, 32 by 18 ft., it is adequate for the industrial-arts division. It contains motion picture projector, slide and opaque projectors, strip film projectors, and other visual aids equipment. This equipment is used for the related work of the industrial-arts classes as well as in connection with a required course in visual education. In the visual education course the students spend considerable time constructing various types of instructional aids as well as learning how to operate and place for the student industrial-arts association.

The Library

An interesting feature of the building is the library. In 1947 all the books and magazines pertaining to the industrial field were moved from the main college library to a room in the industrial-arts building. This room is 30 by 25 ft. and is located on the second floor away from the noisiest shops. The library is well supplied with texts and references in the various industrial-arts areas. Students and staff members find the library, thus situated, a valuable asset because of the easy accessibility of books and reference materials. Much of the students' planning and drawing of projects is done here. A variety of craft and trade journals serve the needs of students and faculty. In addition a large assortment of technical literature obtained from business and industrial concerns is catalogued and filed for easy reference so that students can use it in connection with their required course work.

In addition to its function as a library the room serves as an auxiliary visual aids



Work of visual-education groups

room occasionally and in the late afternoons and evenings for various industrial-arts groups, committees, and related extra-curricular club work.

Special Features

Each shop has a planning and seating area that contains tables, chairs, instructors' desk, bulletin boards, blackboards, and instructional materials for students' use. These areas permit the entire class to be seated for related work, assignments, and some demonstrations. Moreover, students have a place to draw, sketch, and plan during the class session which is usually two hours in length. As has been indicated the visual aids room is conveniently located and may be used for related lectures and discussions, examinations, and the showing of projected aids.

In addition to the usual bulletin boards the graphic-arts shop has bulletin boards on three walls above window height. These boards have colorful displays of the various types of graphic-arts work done by students that add greatly to the attractiveness of the shop. Similar bulletin boards adorn the walls of the drafting room. In the art-metal shop bulletin boards usable on both sides are mounted on pipes fastened to the center of each bench. Instructional material of a ***how to do it*** nature as well as colorful and interesting related material is posted. This is a useful instructional technique and enhances the attractiveness of the area.

Another interesting feature is the student club room on the first floor. This is a sizable room equipped with seats, tables, bulletin boards, piano, soft drink dispenser, and ash trays. A good sized utility room adjoins the club room. The students of the division painted and decorated the room and constructed much of the furnishings. The industrial-arts association uses the room as a luncheon and recreation center after their bimonthly meetings.

Professional Aspects

One hundred twenty-eight semester credits are required for graduation from the Wisconsin State College at Platteville. Thirty-two semester credits are required in shop and drawing for majors in industrial arts. However, because of the guidance of the industrial-arts staff most students graduate with from 36 to 42 semester credits in shop and drawing. Moreover, most students obtain permits to work in the various shops during unscheduled hours and in this way gain more experience than the credits earned would indicate.

A three semester hour course in teaching industrial arts acquaints the student with the philosophy and objectives of industrial arts, organization of subject matter, and methods and procedures for effective teaching. In the equipment and management course the students receive practical detailed experience in planning and equipping a variety of industrial-arts shops. In addition to the specific professional industrial-arts courses the students are pointed toward teaching in all the shop and drawing courses. All shop and drawing courses are professionalized to a degree commensurable with learning the subject matter.

A fortunate aspect of the industrial-arts division is that all the shop and drawing courses required in the major are taught by the industrial-arts staff. Control of the courses, their content, and the manner in which they are taught is under the control of the division. This setup makes for more efficient preparation of teachers and permits constant improvement in the quality of instruction.

The Farm Shop

This shop is 81 by 49 ft. and is located on the first floor of the building. It has approximately 3969 sq. ft. of area. Although the farm shop is a part of the

agriculture division it is described here because of the fine spirit of mutual co-operation that exists between the farm shop instructor and the industrial-arts instructors. Frequently the farm-shop instructor wishes his classes to have some experience in areas of industrial-arts work that his shop cannot provide. The reverse is true in the case of forging, electricity, and farm machinery. This sort of co-operation to the mutual advantage of all concerned is going on more or less continuously. Then too, a number of industrial-arts majors take a minor in agriculture and vice versa.

The farm shop provides experience in farm mechanics such as, hot and cold metal work, pipe work, sheet metal work and welding; farm carpentry, farm machinery, its selection, operation, and maintenance; farm structures; and farm power which is concerned with electrification principles; gas engines, diesel engines, and service and maintenance.

The farm shop program is one of the better programs in the country and is constantly improving its services.

The Product

Graduates of the industrial-arts division are teaching in all sections of the state of Wisconsin, in large, medium, and small school systems. Many are teaching in the surrounding states of Illinois, Iowa, and Michigan, and a scattering have found a place in several other states of the Union. Last November at Milwaukee, Wis., an Alumni association was formed of graduates of the industrial-arts division of Platteville. Any graduate who has not yet been contacted is invited to correspond with the writer.

Although the main objective of the industrial-arts division at Platteville is that of preparing industrial-arts teachers, many of the graduates enter the industrial field. The broad and intensive experience that students can get in several industrial-arts fields makes it relatively easy for them to enter a variety of industrial pursuits. Drafting, designing, building construction, cabinetmaking, tool and die making, electronics, machinery and equipment selling, and furniture manufacturing are some of the industrial lines where our graduates may be found. Some students enroll in our division with industrial employment as their objective. A good general college education plus a strong industrial-arts major make employment in highly skilled areas of industry practically a certainty.

Drafting room

In recent years the field of occupational therapy has expanded greatly. Industrial-arts graduates of accredited colleges can now take an accelerated 13 months' course in occupational therapy and be prepared for employment in this well-paid and humanitarian work. Several of our graduates are in this field now and others are planning on preparing for this work.

Conclusion

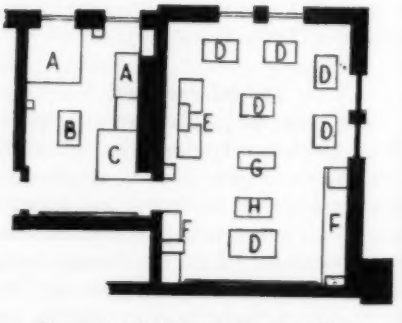
Since 1945 the industrial-arts division of the Wisconsin State College at Platteville has made enormous strides forward and now holds high rank in comparison with other colleges in the country preparing industrial-arts teachers. This achievement is the result of the efforts of a capable, hard-working, forward-looking staff and the backing of the college administration. It is the belief of the writer that the industrial-arts division will continue to grow and to adopt new ideas and techniques to the end that industrial-arts education may be advanced.

The Industrial-Vocational Addition to Piqua High School

W. K. DUNTON
Supervisor of Vocational Training
Piqua, Ohio

A review of school shop building plans in recent issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION "school shop annuals" makes it evident that progressive schools are endeavoring to adapt their industrial-vocational programs to the specific needs of their local communities.

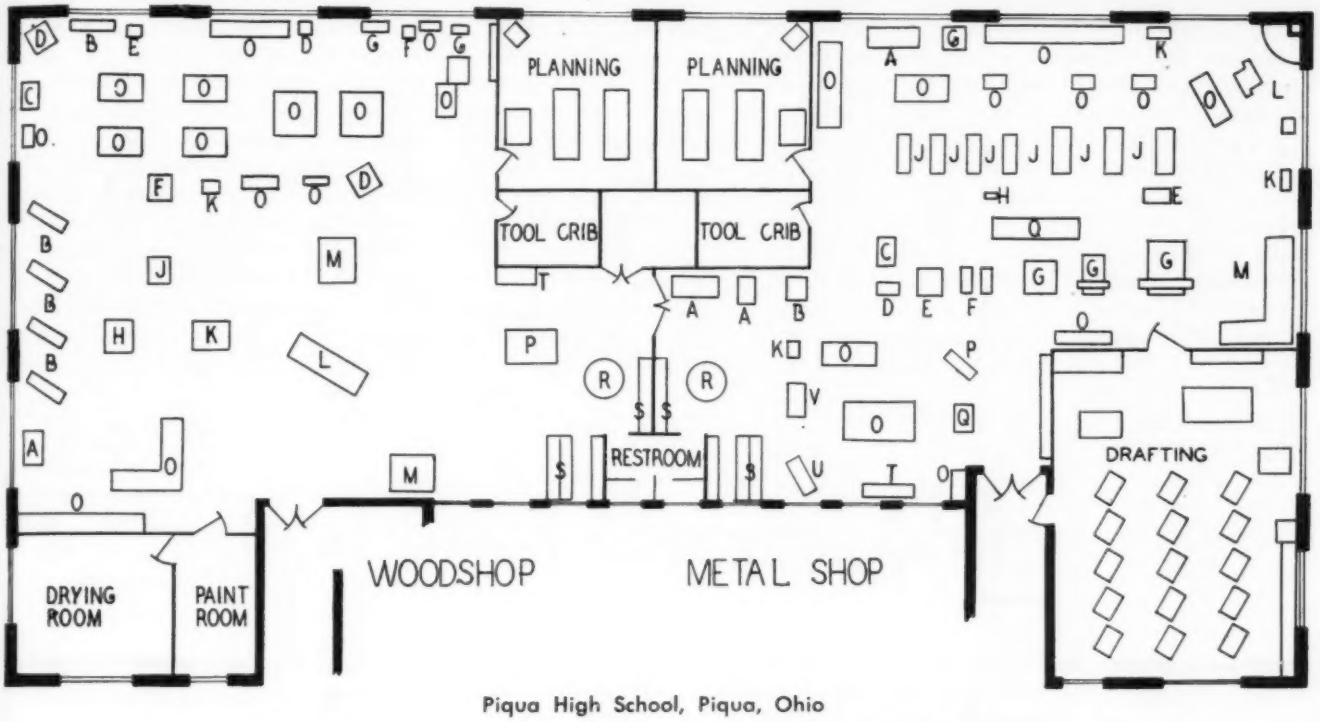
The recent addition to the Piqua, Ohio, Central high school, and the program that



Piqua High School, Piqua, Ohio

PRINT SHOP

A. press; B. imposing stone; C. cutter; D. cabinets; E. galleys; F. storage; G. proof press; H. layout.



Piqua High School, Piqua, Ohio

WOODWORK EQUIPMENT

A. Mortiser; B. lathe; C. shaper; D. jig saw; E. spindle sander; F. drill press; G. grinder; H. planer; J. disk sander; K. hand saw; L. jointer; M. saw; O. bench; P. wood rack; R. washbasin; S. lockers; T. hardware.

METAL-SHOP EQUIPMENT

A. Surface grinder; B. cut-off saw; C. hack saw; D. Do-All; E. drill press; F. shaper; G. miller; H. press; J. lathe; K. tool grinder; L. forge; M. foundry; O. bench; P. buffer; Q. shear; R. washbasin; S. lockers; T. bar folder; U. forming roll; V. pan brake.

it and its supporting junior high schools make possible, were planned on just such a premise: meeting the needs of the community and its people.

When the present high school building was constructed in 1914 no provision whatever was made for shop facilities, although the annual report of the Piqua superintendent of schools as far back as 1900 said, "It would seem a question of vital importance whether some instruction in manual training might not be added to our curriculum."

Community Influence

Piqua is not a large city (population 19,000) but it does have diversified industries manufacturing hydraulic machinery, airplane propellers, special tools, automobile bodies, furniture and veneers, ventilating fans, industrial felt and textiles, and a number of *subcontract* and *model* machine shops. It is also the center of a prosperous agricultural area. Besides, many of its citizens are employed in the industries of Dayton and other Miami Valley towns.

Over the years the influence of employment opportunities and the needs for training resulted in some additions being made to the curriculum. Industrial-arts shops were located in dark basement catacombs that the original building plans indicated as coal bunkers and janitor's quarters. A vocational-agriculture department was established in the basement of a grade school some distance from the high school. Following an occupational survey of the community a vocational machine shop was established in an unused portion of the municipal power plant.

By 1948 community interest in an expanded vocational-industrial program had developed to the degree that the board of education proposed a bond issue of $300,000 for a shops addition to the high school. This proposal was acted upon favorably by the voters but rising costs made it necessary to request an additional $75,000 which the electorate also approved.

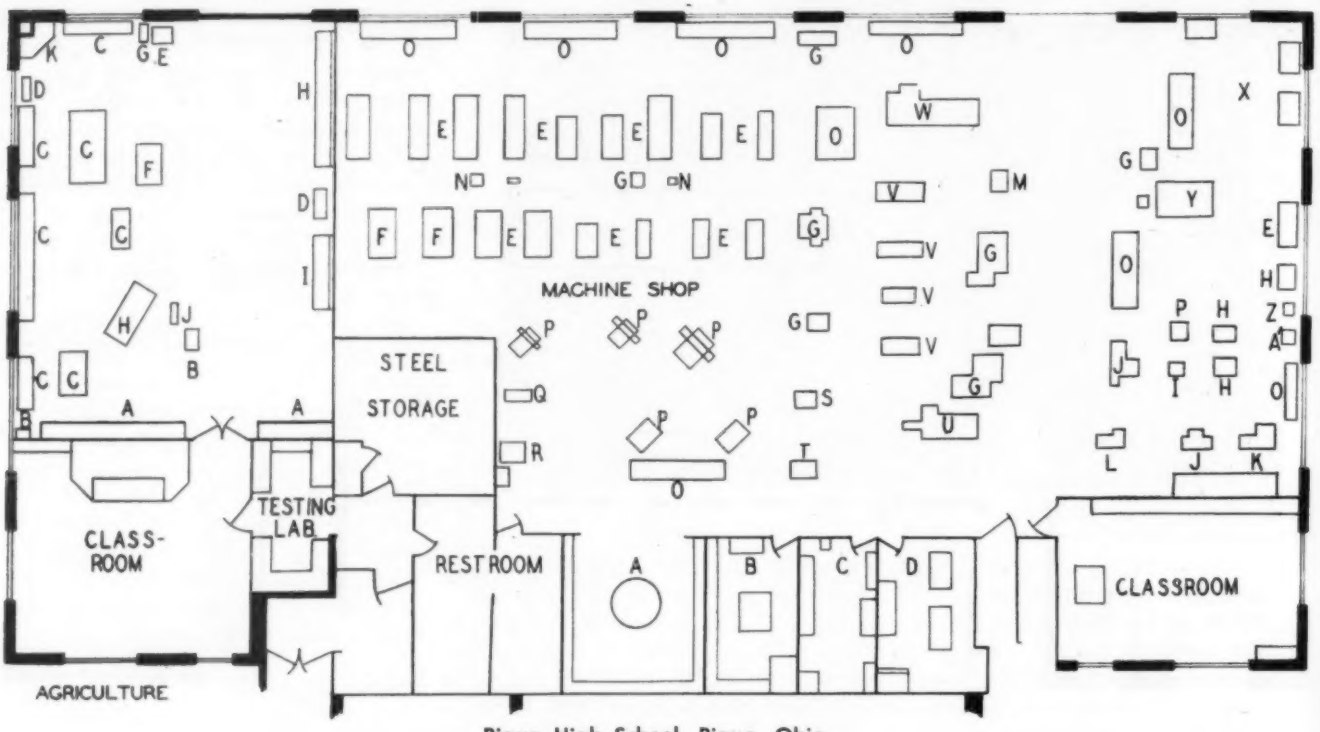
Methods of Planning

When funds became available the refinement of the architect's tentative plans was started. The board of education and the administration operated upon the theory that the men who would do the actual teaching knew the most about what was needed in the shops. These teachers, calling freely upon industry for advice, and visiting many other schools to secure the benefit of others' experience, worked tirelessly in planning their areas.

As they planned the facilities the teachers kept constantly before them certain principles. The building should be well adapted to the courses of study and enrollments for both in-school and adult classes. Adequate space should be provided for the machine and work areas, and for material and tool storage. Provision should be made for convenient and adequate planning and classrooms. Power, light, heat, and ventilation requirements should be fully met. Shop layout and general plan should facilitate efficient class organization and management. Throughout the shops and classrooms all safety factors should be given full consideration.

Space Allocation

Final plans resulted in the inclusion of five shops in the addition and provision for space for one other in the old building. The vocational-agriculture shop provided over 1600 square feet of floor space, not including the classroom and laboratory, for



Piqua High School, Piqua, Ohio

AGRICULTURE

A. Tool rack; B. hardware; C. bench; D. grinder; E. drill press; F. saw; G. welders; H. wood rack; I. jointer; J. band saw; K. forge.

MACHINE SHOP

A. Washroom; B. gauge room; C. tool crib; D. office; E. lathes; F. turrets; G. drill press; H. surface grinder; I. drill grinder; J. universal; K. tool-cutter grinder; L. internal grinder; M. carboloy grinder; N. pedestal grinder; O. bench; P. millers; Q. hack saw; R. abrasive cutoff; S. band saw; T. filer; U. boring mill; V. shaper; W. planer; X. heat treat; Y. welding; Z. center lap; A1. belt sander.

use by in-school students, young farmer groups, and veteran on-the-farm trainees. The vocational machine shop was allocated nearly 6000 square feet for the machine area, plus space for classroom, office, toilet and washing facilities, tool crib and gauge room, and was planned for use by day-trade students, trade-extension classes, and pre-employment trainees. The industrial-arts woodworking area provided 3400 square feet of shop space plus planning, painting and drying rooms, tool crib, and overhead deck for lumber storage, and was planned for both in-school and adult groups. The industrial-arts general metal shop made available 2800 square feet of space for instruction in sheet metal, art metal, elementary machine shop, and forge and foundry work, in addition to an adequate planning room, tool crib, and overhead deck for the storage of materials and supplies. The drafting room provided nearly 1000 square feet of space and was planned for both in-school and trade extension classes. The print shop was located in rooms in the original building which are adequate and were made available by the construction of the addition.

Outstanding Features

A combination of many features makes this vocational-industrial addition to a traditional 35-year-old high school building outstanding, in the opinion of its users.

First of all, it was designed for what it was intended to be: a *shop building*. The traditional school theories of architects were replaced by the general principles of factory construction. The provisions for floor stressing, for adequate artificial and natural lighting, for the use of reinforced concrete columns instead of steel beams, for the elimination of old-school *gingerbread*, and for disregarding the 22 by 30-ft. multiple size factor that has so frequently influenced school shop construction, made it possible to closely follow current practices of industrial construction. Outwardly, however, the addition conforms well to the general appearance of the building to which it is attached.

Second, the adequacy of the space provided has greatly increased and improved opportunities for providing learning experiences. The agriculture shop can readily accommodate any ordinary farm machinery that is brought in for repair. The number of stations in the machine shop makes possible the elimination of much wasted setup time in that it is not usually necessary to remove work in process to make machines available for other day or evening classes. The wisdom of providing really adequate space in the woodworking shop became evident when, with no increase in enrollments, time, or stations, it was found that the production of high quality projects had nearly doubled over that in the shop's former "catacomb" environment. The general metal shop, with two or more areas in use at all times, makes possible much greater achievement in all areas due to the absence of interference.

Third, from the points of view of both student learning and shop management, the provisions for readily accessible planning rooms and shop libraries; convenient and easily supervised tool cribs; ready access to supplies and materials, teaching aids, and washing, toilet, and locker facilities, make the addition a place where teachers can *teach* rather than *manage* classes.

Fourth, carefully thought-out and well-planned electrical facilities make possible

not only the present efficient use of the shops, but if changes are decided upon, make easy the relocation of machines or the installation of others. Fluorescent lighting was installed with foot-candle ratings based on the specific needs of different areas. Electrical convenience outlets, sufficient in number and placed for the convenient use of power tools and welding equipment, were located throughout the shops. A complete installation of 600 amp. and 225 amp. bus duct reaches all shop machine areas.

Finally, the adequacy in number, size, and type of machines and machine tools in the various shops makes it possible to plan courses of study that provide for the fullest possible development of the students in both vocational and industrial-arts education. The $373,605 spent for the addition does not include the cost of machinery, tools and equipment, most of which was secured from war surplus.

The instructional staff is composed of E. J. Hampshire in general metal and drafting; John Frehse in woodworking; Lester George in vocational agriculture; Earl Slaughter in printing; and Leslie Hillier and Lloyd Gilbert in vocational machine shop. Earlier instruction for the students is provided in the junior high shops by Lowell Lewis and Donald and Darrel Lowell. The program is under the general supervision of W. K. Dunton. R. G. Winter is high school principal, and C. M. Sims is superintendent of schools.

For the critical curriculum-conscious reader it may be added that in Piqua, basic electricity, plastics, and leather craft are taught in the junior highs. There is also instruction provided in fine arts at the high school.

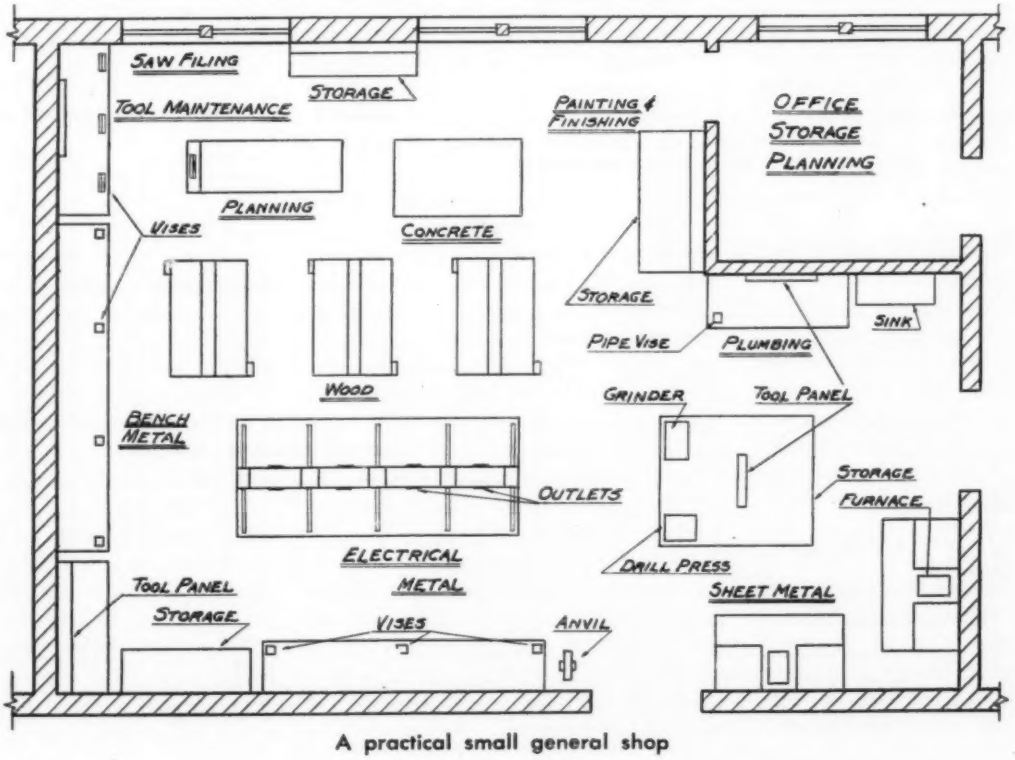
A Practical Small General Shop

GEORGE A. WILLOUGHBY
Professor and Department Head
Michigan Normal College
Ypsilanti, Mich.

The accompanying illustration shows what can be done in a small shop to provide practical general-shop courses and elementary "unit" courses emphasizing the development of boys and girls through planning and the extensive use of the more common hand tools.

This shop is 25 by 35 ft. and has provided work space for hundreds of students for over twenty years. Classes as large as twenty can be served readily in such courses as "household mechanics," "elementary general shop," "elementary metalwork," "elementary electrical work," and "practical shop sketching and drawing," especially when integrated with woodwork, metalwork, electrical work, and the like. The shop can be used also for a number of the so-called arts and crafts activities.

A study of the plan will show that full



A practical small general shop

use has been made of the available wall space to provide numerous work stations, with tool maintenance and finishing nearest the windows. The bench tops are 2 ft. wide except for sheet metal where the width is 3 ft. The electrical bench is made up of two 2-ft. benches back-to-back.

A surprising amount of storage space is provided in each bench by built-in drawers and cabinets. The drawers may be assigned to students as "lockers" or some may provide storage for supplies and equipment near the points where they are used. Soldering fluxes and other material may be supplied at the soldering bench, plumbing fittings may be kept in the top drawer of the plumbing bench, and finishing material may be stored in a metal-lined, fireproof section of the finishing bench.

The general plan for tool arrangements is to have the most frequently used tools available on small panels near the areas where they are needed; the less commonly used tools grouped on large panels readily accessible to all; and the more expensive and less common or easily broken tools, such as drills, taps and dies, micrometers, or wire gauges, under the direct supervision of the instructor who may check them out and in as required.

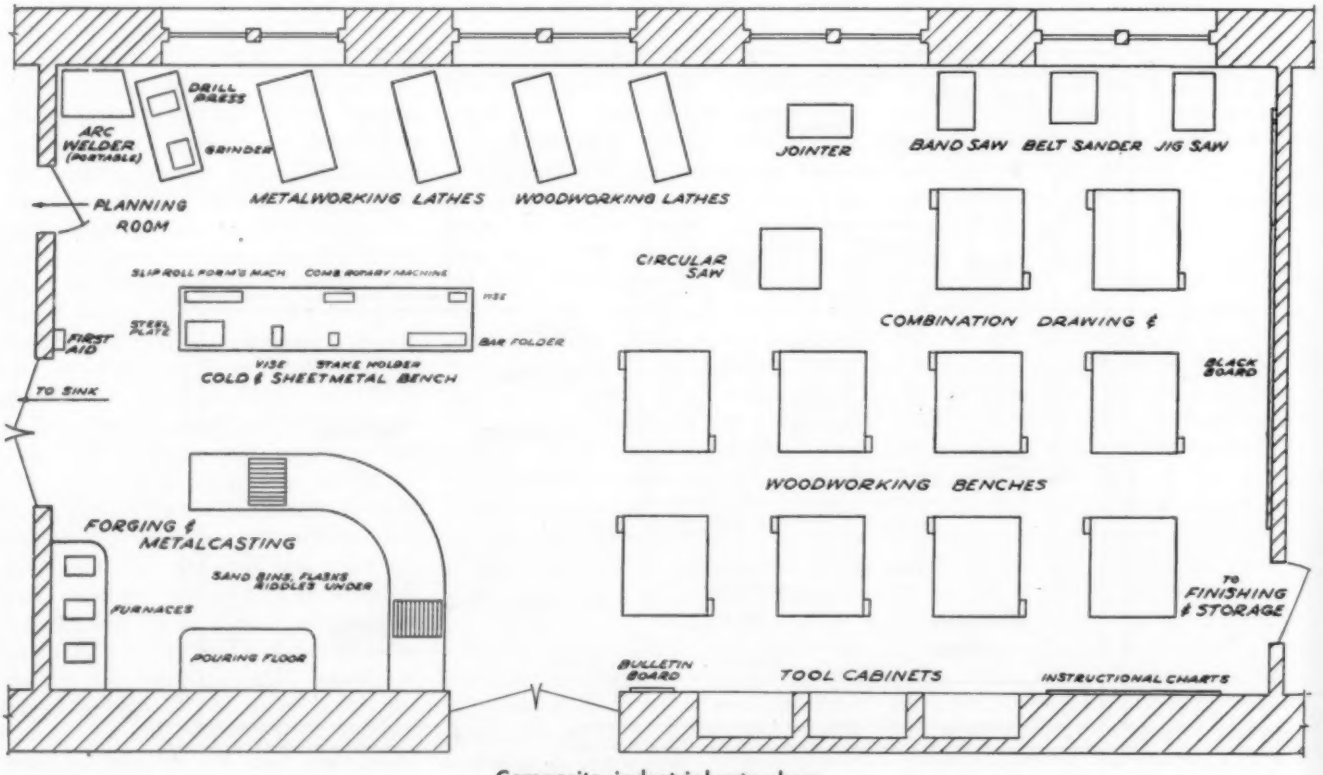
A shop of this kind can be established in almost any school where a room is available and may well provide a basis for an expanded industrial-arts program as the value of such a program can be seen and appreciated by the school community.

A Composite Industrial-Arts Shop

GEORGE A. WILLOUGHBY
and
RALPH GILDEN
Michigan State Normal College
Ypsilanti, Mich.

The accompanying plan illustrates how a typical woodworking shop of ancient vintage was modified to provide for general woodworking, general metalworking, and drawing and planning. The arrangement has worked out successfully for many years and may well be considered not only when planning the transformation of old shops but also when planning new ones.

The shop room is 25 ft. wide and 50 ft. long with windows and doors arranged as indicated. The main entrance opens from a hall through a double door in the side of the room. This entrance area provides the division between the metalworking area and that devoted largely to drawing and general woodwork. This is desirable not only from the standpoint of convenience but also to eliminate fire hazards between the metal- and wood-working areas.



Composite industrial-arts shop

It will be noted that most of the major types of metalwork and woodwork can be carried on. Metal casting, simple forging and welding, some bench metal and extensive sheet-metal work, as well as metal turning and other lathe processes can be done in the metalworking area. Metal spinning can also be provided. The benches in the woodworking and drawing section make possible close integration between drawing and woodwork, or between metalwork and bench woodwork, machine woodwork, and other types applied to carpentry or patternmaking. One of the decided advantages of this arrangement lies in the fact that one can make drawings, patterns, castings, and machined parts in the desired sequence and thereby integrate the whole procedure from planning to finished product.

The metal-casting unit is worthy of note. It has been in operation for many years and has recently been modified to present a very modern appearance as indicated. This has always been one of the most successful areas in the shop. The work has been limited largely to the casting of aluminum but this has been found highly desirable in terms of the possibilities of design and the ease of obtaining and handling this metal. Hundreds of castings of all descriptions have been made in this area by boys and girls of all ages. They range from Lincoln heads to bases for machines.

It will be noted that built-in wall cabinets have been provided for the storage of the major tools. This has been found desirable in many respects but much wall space is not usable in the vicinity of these and care must be exercised to avoid congestion. Many of the tools used at the lathes, the sheet-metal bench, and the casting unit are arranged near the areas where they are used rather than in the cabinets; leaving these for the tools to be used in the drawing room and the woodworking shop.

All of the space devoted to metalwork in this shop was gained originally by regrouping the workbenches and the machines as indicated. The student work seems to be as good as, or better than, it was when the whole room was occupied by single benches and machines placed out in the room. Some of the machines are now on casters so they can be moved out from the wall if desired. However, it is surprising how well they function as they are arranged near the wall.

Development of Industrial Arts in the Beloit Public Schools

FRED S. DARLING
Industrial-Arts Supervisor
Beloit Public Schools
Beloit, Wis.

The development of the industrial-arts department in the Beloit public schools has made considerable progress the past forty years. About 1912, the school board approved the addition of manual training as an elective subject in the course of study. This was a hand tool course in woodwork, and the room was located in the basement of the school. It was well lighted, but lacked proper heat and ventilation; with woodwork as a starting point, mechanical drawing was soon incorporated as part of the course, and was first taught in connection with manual training. Later, however, the two courses were separated and assigned to individual rooms. About 1916, a course in printing was included. In the meantime the woodworking course had expanded to include some woodworking machines, and cabinetmaking had been added to the list of selectives.

In the late twenties and early thirties, a course in general metals was offered. This was taught in the woodwork shop. As the enrollment of the school increased and more space was needed, it was necessary for the school board to rent another building. This was an old feed warehouse, known to the students as the *annex* or to some as the *lower campus*. The first floor of this building was divided into two sections. The general metals class was transferred to one and enlarged to a machine shop. The other section was used for auto mechanics. These rooms were small and there was no room for expansion.

At the outset of World War II, a section of the auto-mechanics was converted to welding. Here two stations were set aside for gas and five for arc. The drawing classes were moved from the basement to a room on the second floor of the annex. It was well lighted and the ventilation was improved, but because of the structure of the building, heat was a problem. It was uncomfortably cold in the winter months and because of the flat roof, the late spring and early fall days were extremely hot. The windows with the exception of two small sections about two feet square, could not be opened.

New Building Completed

During the many trying days in the old building we were always looking forward to the day when we would move into a new building. The people of Beloit wanted a new school, but because of the war, shortage of materials, and the ever increasing cost of labor and equipment, it seemed advisable to delay the project for a time. Nevertheless the planning went on for our new industrial-arts department. We gave a great deal of thought as to how shops could be laid out in order to give the greatest amount of efficiency.

Finally the war was over. In 1949 ground was broken and a new building began to take form. It is a three-story brick structure, over 800 ft. long and is

built in U shape. The cost of this beautiful building known as "Beloit Memorial High School" is four million dollars. The front rooms are taken over by the academic department and the administrative offices. To the north is the gymnasium, the south end contains the auditorium, band, and shops.

The industrial-arts department is on the first floor, directly back of the auditorium. It covers an area 202 ft. 6 in. long, by 112 ft. 6 in. wide. In this unit we have six shops, a visual aids room, teachers' study, and industrial-arts office. The shop area is a one-story wing, so arranged that rooms are exposed on two sides; each well lighted and ventilated. All rooms with the exception of mechanical drawing have direct access to the outside; all windows except those on the north side are blue glass. This eliminates the direct sunlight but permits the admission of sufficient daylight.

Drawing room, woodshop, and print shop

The curriculum of the school has been broadened the past few years to include a complete industrial-arts course. The department now offers the students 17 different selections in the field. In woodwork we have four selections, elementary which is a prerequisite to the other three, namely, cabinetmaking, patternmaking, and carpentry. In mechanical drawing we have a class for beginners, one in machine drawing, and one in architecture. Elementary drawing is a prerequisite for all second-year electives in any field, with the exception of auto mechanics, printing, and elementary woodwork. Boys can elect three years of printing.

The machine shop is not completely equipped with all types of machines, but we do offer two years of training. In welding the students select either gas or arc welding, or they may elect both. Part of this room is used for teaching sheet metal, and a section of the auto-mechanics shop is set aside for a farm shop. The department has a separate room used for visual aids. This is the only complete darkroom in the building and is in constant use by our industrial-arts classes. We have started a film library and have films on all basic machines. Other films of a consumer nature can be requested on a rental or free basis.

The New Equipment

We in the industrial-arts department are proud of our room arrangement. Naturally, in the construction of this costly type of building, some things have to be sacrificed. Our equipment fell under this category, but it has been included in our budget covering a three-year period; the furniture in the drafting room was refinished and a new blueprint machine purchased, making this unit complete. The sheet-metal shop was completely equipped this year, although many items are still on back order.

We are hopeful that the woodshop will receive all new Yates-American machines, before the close of the school year. In the auto-mechanics classes, we are in need of many new testing devices. The print shop, when completely equipped, will have a flat bed press and a linotype machine. In the machine shop, we have requested a floor type lathe and a large milling machine. This department takes care of all the maintenance for the system that can be worked into classroom assignments, for this reason the floor type lathe and the large milling machine would be of great value. Last year the cabinet classes devoted about three weeks to the construction of eighty tables, to be used in the commercial department. We do not advocate work of this nature unless we feel that some teaching can be connected with the performance of the project.

The enrollment in the industrial-arts classes consists of about half the student body. The only class that is opened to girls at the present time is mechanical drawing. It is our hope that either by extending the number of periods, or the addition of more instructors, that it will be possible to allow the girls to select other courses in the department.

Since industrial arts offers the opportunity for practice in planning and problem solving, and also provides for thinking in terms of concrete materials, it has much

Welding, machine shop, and auto mechanics

The new industrial-arts department, Beloit High School, Beloit, Wis.

to offer to the general objective of teaching pupils to think and thereby tends to improve the emergent culture. We shall strive by the use of better equipment and the best instructive methods of teaching, to prepare our students to take their proper place in the industrial field. It is the intention of every instructor in the department to continually grow professionally and thereby keep abreast with all that is new in methods and equipment. We can accomplish this best by working together in departmental meetings where the course of study can be carefully checked and adjusted. Here in Beloit a civic-industrial committee has been formed. It consists of a representative group of men from the various industries in the city. This committee will act in an advisory capacity, and we hope, help us to establish a closer relation between school and community.

Home Workshops or Work Areas

GEORGE A. WILLOUGHBY
Professor and Department Head
Michigan State Normal College
Ypsilanti, Mich.

"Home Workshops: Their Encouragement and Development" may well be one of the most important objectives of teachers of industrial arts. This is because the home workshop, however simple it may be, can provide a basis for any of the following:

1. A closer relationship between the school and the home through encouraging and assisting in useful and interesting applications of abilities and knowledge gained in school to selected projects that can be planned and constructed in the home.
2. An interest in the purchasing, caring for, using correctly, and arranging conveniently of tools and devices for use at home.
3. An interest in planning and doing things that are worth while and interesting during spare time.
4. An interest in planning and making new things for the home or its surroundings.
5. An interest in keeping everything around the home and surroundings in good repair.
6. An interest in making things for others.
7. Opportunities, in some cases, to develop greater skill by continuing applications of things learned in school in specialized work at home.
8. Opportunities to do some things in the school shop necessary to complete projects originated in the home shop.
9. Opportunities to develop interests and

skills in activities not carried on in the school shop but involving the use of tool processes and ideas obtained in the school.

10. Co-operative undertakings in the home with members of the family, especially with the father, and a better understanding of the work of the school and the industrial-arts teacher.

How the Teacher Can Help

The teacher can help in the development of home workshops and activities in any or all of the following ways:

1. Point out to his pupils the values of home workshops or work areas.

2. Organize a home workshop club to develop and exchange ideas.

3. Furnish plans or ideas for some of the equipment for the shop and encourage pupils to make a number of things in the school shop that can be used at home.

4. Encourage pupils to draw plans for their shop or work area and bring them to school for suggestions and constructive criticism by the teacher.

5. Set up some work areas in the school shop that may be used as a basis for duplication in a home workshop.

6. Promote activities that can be carried on in home workshops such as the building of birdhouses, constructing toys at Christmas time, and making things for the garden.

7. Evaluate the work done in home workshops by having pupils bring in their work. Sometimes the parents may be called upon to assist by certifying that certain things have been accomplished.

8. Co-operate with parents in the recommending of tools or machines to be purchased. (Have some of the machines in the school shop if possible.)

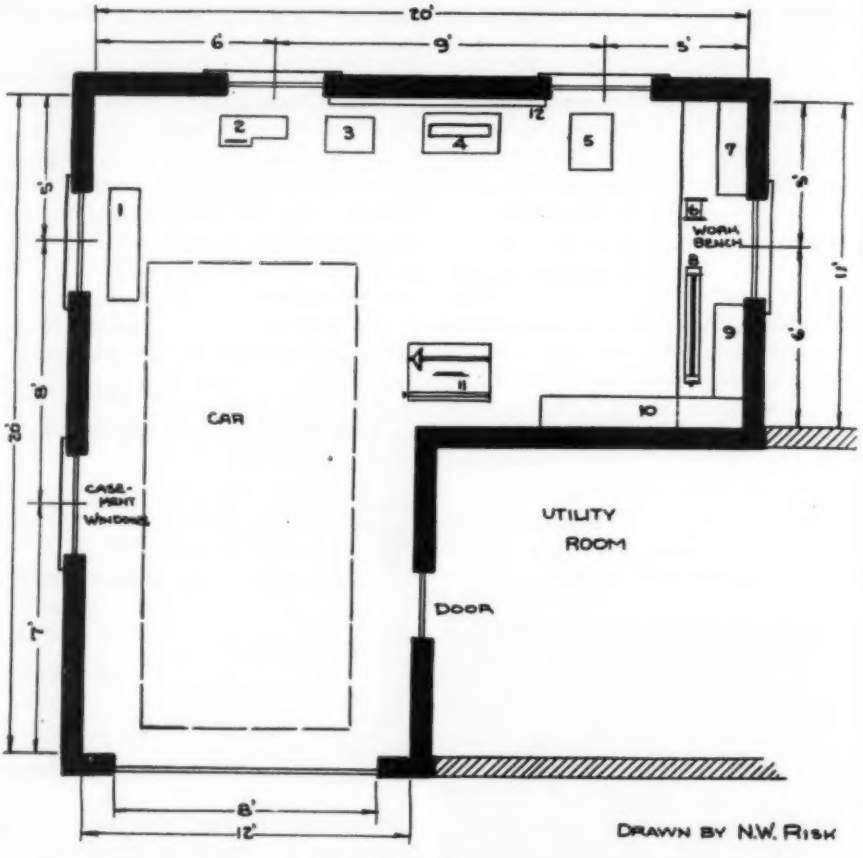
9. Encourage pupils to gather and put in good repair all of the tools available around the home. (This may be done in the school shop under maintenance and repair as part of a course.)

10. Provide citations or awards from the community for outstanding accomplishments in home workshop activities.

Types of Home Workshop Activities

An analysis of the things of a constructive nature that boys and girls undertake at home and of things that they would like to do if facilities were available, will indicate numerous and varied activities. These things should be given consideration if the full value of "home workshop" activities is to be realized.

In the broad sense, it may be accepted that any activity in the home or its surroundings may be considered a "workshop" undertaking even though it does not require elaborate space, or large numbers of tools or machines. It is well to consider the value of any constructive undertaking to young or old in providing opportunities for pleasant pastime activity and general development as well as the ultimate product of a material nature. Thus all activities may well be considered.



Home workshop layout

1. 6-in. jointer; 2. disk-belt sander; 3. shaper; 4. 14-in. bandsaw; 5. 14-in. drill press; 6. bench grinder; 7. cabinet; 8. bench lathe; 9. cabinet; 10. supply case; 11. 10-in. combination saw; 12. tool panel.

With the foregoing thoughts in mind it will be understood that consideration should be given to the facts that some boys or girls like to draw, to do wood carving, to whittle, to weave, to do certain types of work with art metal and plastic materials as well as other activities somewhat limited in nature. In addition to these we know, of course, that boys, and many girls like to do hand woodwork of a general nature; to do machine woodwork with a jig saw, a lathe and perhaps other machines; to make household "gadgets" of wood or metal; to have a general workshop for all kinds of repair and construction undertakings; to have a small print shop; to have a machine shop for working metals; and many other arrangements for carrying on home activities.

All of these possibilities should be considered in an *over-all* home workshop development.

Location and Development of Workshops or Areas

The selection of the location of a work area in the home or its vicinity must be based on the space available, or to be provided, and the nature of the work to be undertaken. The following locations may be considered:

1. A desirable corner in a room in the home or an available room suitable for certain *clean* types of work

2. The basement of a home or a portion of a basement where certain types of work can be carried on under healthful conditions

3. The attic of a home, remodeled to meet the requirements for certain types of undertakings

4. A part of a garage

5. A shop attached to a garage
6. A separate shop building

Suggestions for Getting Started

One should not hesitate to get started as soon as possible in some home activity, even on a small scale, and then plan and develop more extensive facilities for the future. The following suggestions may be helpful:

1. Decide on the type or types of work to be attempted.

2. Decide on the minimum work space required and possible locations of the workbench, table, or other essential equipment.

3. Draw a proposed plan or work out ideas definitely in preparation for arranging the equipment and work space necessary.

4. Check on the lighting and ventilation as well as the heating of the work space.

5. Clean the work space if necessary and arrange for electric convenience outlets if new ones are required.

6. Arrange for the removal of dust if necessary.

7. Get all of the ideas and assistance that you can on the following:

a) Arrangement of work areas for the things you are going to undertake at first.

b) Types and locations of tools and equipment for convenience and maintenance.

c) Things that can be done in the fields of work you have selected.

SCHOOL SHOP PLANNING WITH 3-DIMENSIONAL SCALE MODELS

ARTHUR D. ANDERSON
Graduate Student
Wayne University
Detroit, Mich.

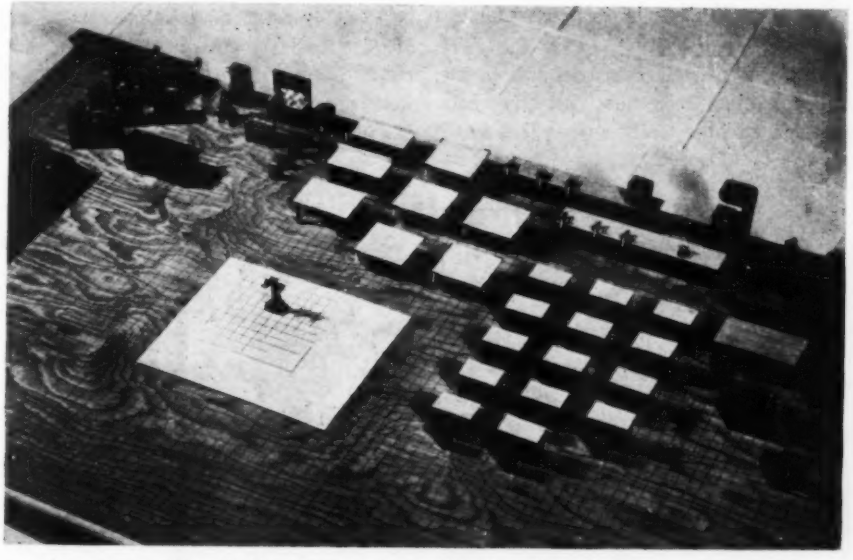
Wayne University offers in their graduate program a dynamic school shop planning course based around the use of three-dimensional scale models of equipment as the medium for planning. This article was written as a guide to those who are not familiar with or have not employed such models in solving school shop planning problems.

Those who have employed them in their planning problems have found them an accurate and quick method of solving all phases of school shop planning. Three-dimensional models give the planner or planners an accurate insight of space, equipment arrangement, color dynamics, and all factors of final full scale arrangement that the past two-dimensional method could not offer.

The planner in the Detroit area can borrow on a rental basis from Wayne's department of industrial and vocational education visual aids library the models of equipment he needs to carry out his shop layout.

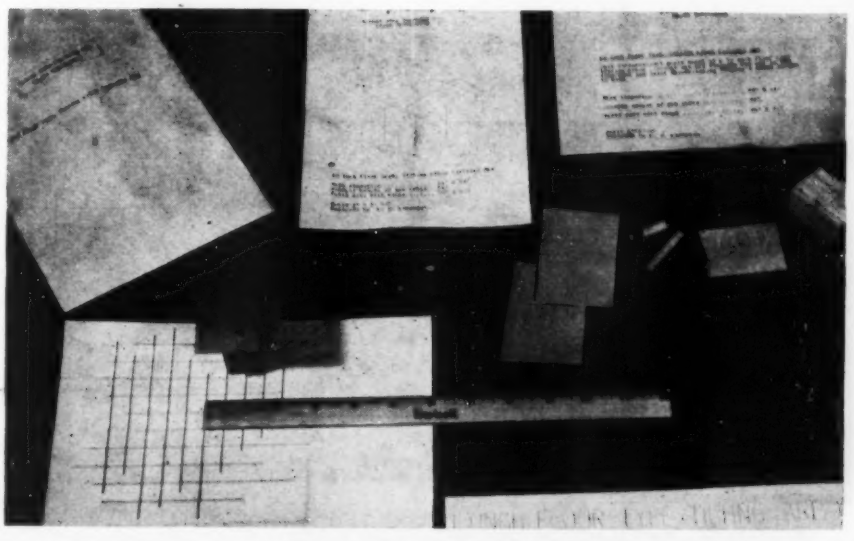
Members of the department have developed a three-dimensional scale model kit plan which is offered as an aid to all in-service teachers who are involved with school shop planning.

No planner or planning committee can set forth its proposed departmental needs or needed facilities more comprehensively to all concerned than through a presentation of a scale model layout.



A cross section of planning scale models found in Wayne's department of industrial arts and vocational education visual aids library. Note scaled planning board

— Photo by B. Suda



Typical content of 3-dimensional scale model equipment kits are as shown: labeled envelope, blueprint, specification sheet, pre-cut materials, sandpaper, and numeral tag. Scale: ½ = 1' 0"

— Photo by B. Suda

Northeastern State College Industrial-Arts Building, Tahlequah, Okla.

M. E. FRANKLIN
Chairman, Industrial-Arts Department
Northeastern State College
Tahlequah, Okla.

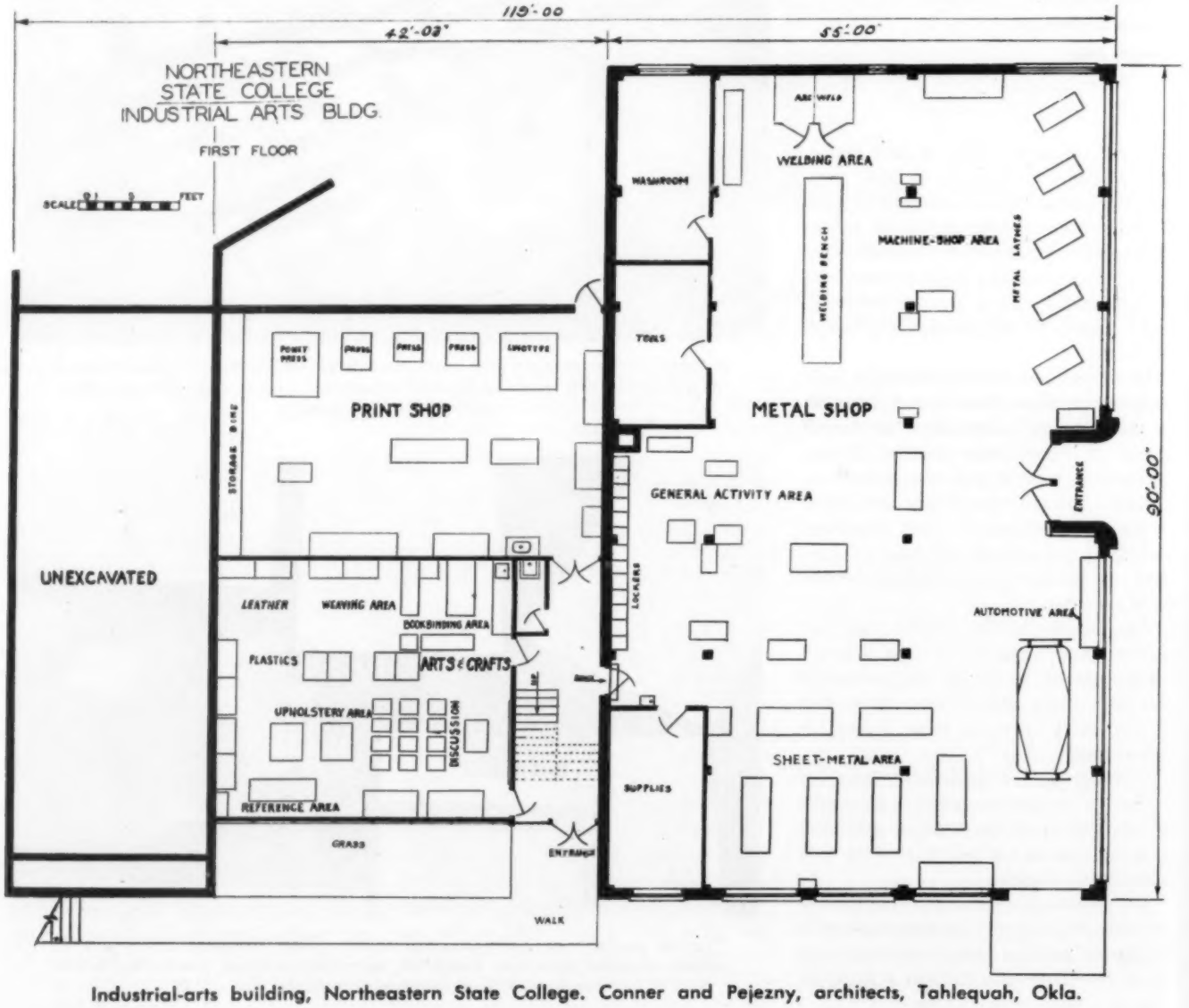
While the present industrial-arts building is not entirely new, yet the new extension and the modifications that have been embodied make what seems to be an entirely new plant.

The building is now approximately 90 by 120 ft., most of which is two stories high. It is built of concrete, steel, and brick, with large glass areas to furnish as much natural light as possible for all work areas.

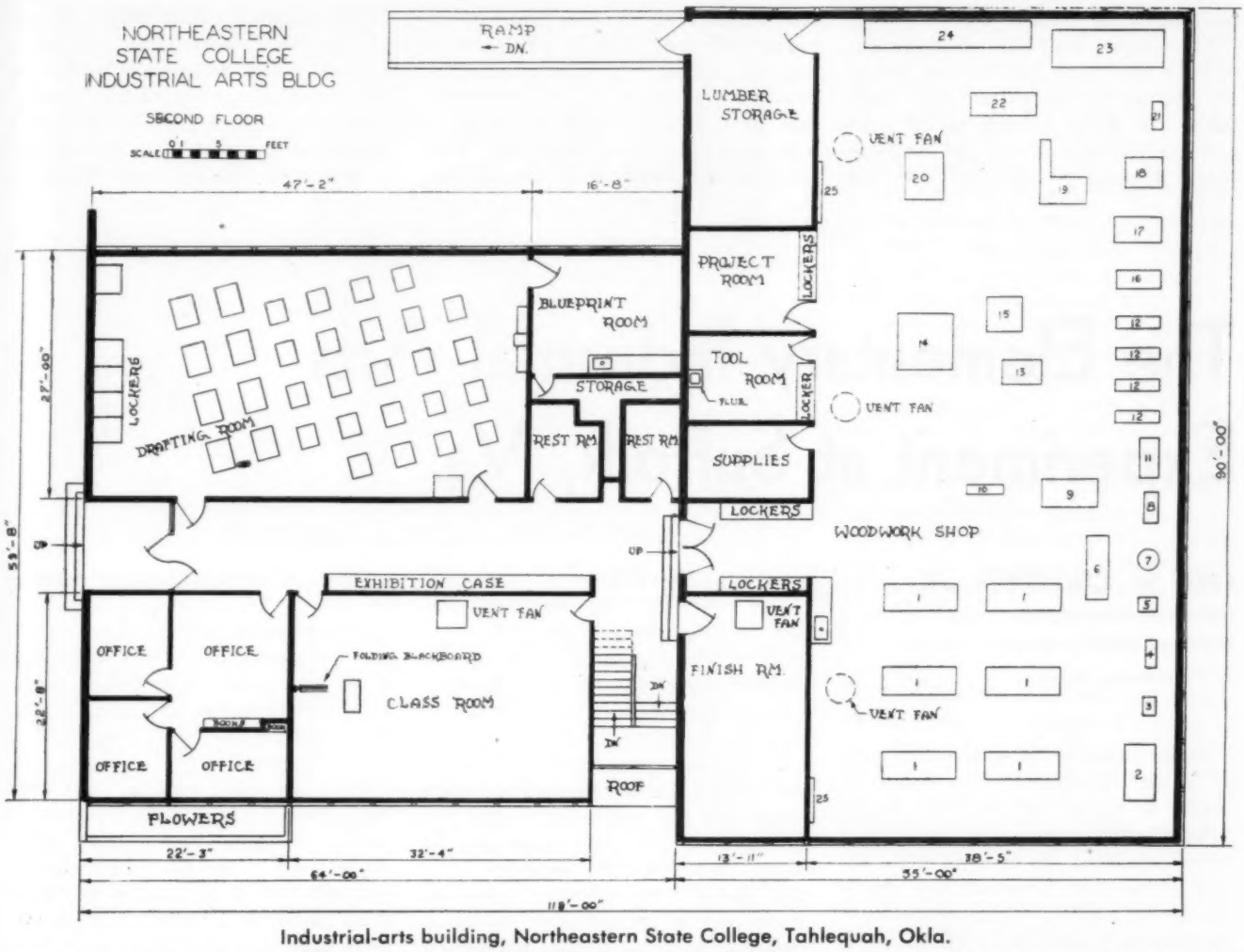
The subjects offered are metalwork, woodwork, drafting, printing, and arts and crafts.

Besides the various shops, there is a large modern classroom, and ample office space.

A new program has been launched at Northeastern which consists of a crafts program for adult Indians and others to be carried on in the same space formerly

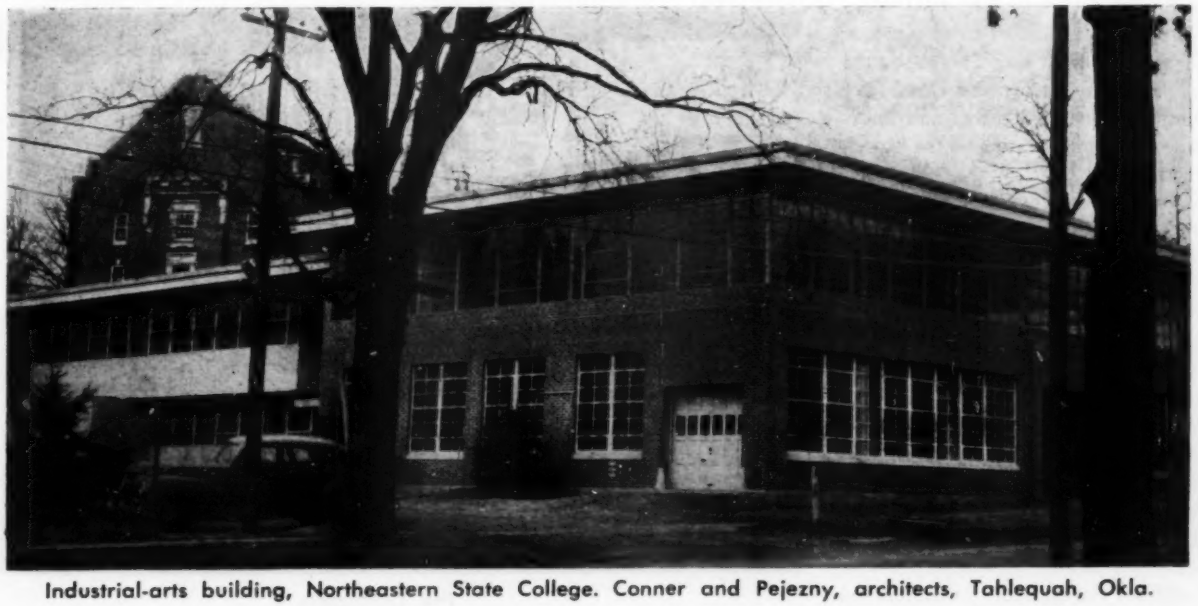


Industrial-arts building, Northeastern State College. Conner and Pejezny, architects, Tahlequah, Okla.



Industrial-arts building, Northeastern State College, Tahlequah, Okla.

1. Workbenches; 2. drawing table; 3. grinder; 4. press; 5. drill press; 6. jointer; 7. disk sander; 8. trimmer; 9. band saw; 10. tool cabinet; 11. portable fan; 12. wood lathes; 13. radial saw; 14. glue table; 15. shaper; 16. router; 17. jig saw; 18. mortiser; 19. surfacer; 20. circular saw; 21. grinder; 22. jointer; 23. belt sander; 24. radial saw; 25. bar clamp racks.



Industrial-arts building, Northeastern State College. Conner and Pejezny, architects, Tahlequah, Okla.

occupied by the machine woodwork shop.

This program is an effort to supplement the fine work done in this area among the Indians to revive the older crafts among the adults as well as the work with the Indian youth of the Sequoyah Indian Training School. This work has been promoted by Mr. Bill Ames of the Indian Service and through an association sponsored by him, the Sequoyah Indian Weavers. It has grown to the place where they need more facilities and a tie-up with some institution where the more promising of the youth may continue their craftwork and yet secure the needed college educational work which will enable them to become teachers or workers in such related fields as occupational therapy.

The program when started will be a project co-operated in by the Indian Service and the Northeastern State College.

The Elementary Industrial-Arts Experiment at Suffolk, Va.

FRED W. CULPEPPER, JR.
Industrial-Arts Instructor
Matthew Whaley School
Williamsburg, Va.

Industrial arts in the elementary grades in Suffolk, Va., started as an experiment carried on by the industrial-arts department of Suffolk High School. Our purpose in the experiment was to prove to the administration that industrial arts was a worth-while addition to the curriculum of the elementary school and when integrated with the academic subjects, would broaden and strengthen the student's education in these subjects.

The program was limited to grades four through seven which were housed in the Thomas Jefferson School. The elementary school adjoined the high school and therefore made the administration of the experiment more simple.

There was no shop or extra room available for such use in the school. A very limited number of tools were on hand in the school, and the administration was unable to supply any large sum of money for the experiment.

With these limitations on the program, the activities were conducted using the *toolmobile* which combined in one mobile unit the following features:

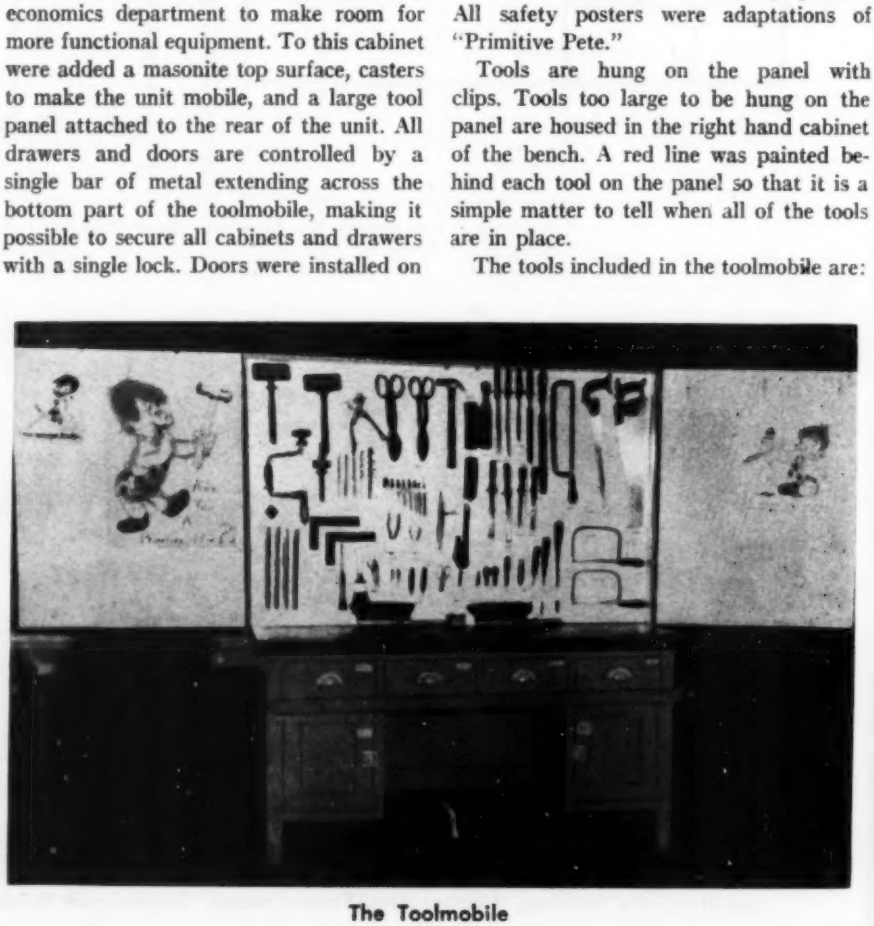
1. A workbench
2. A tool panel with sufficient number of tools to equip a class of thirty to forty students
3. Sufficient storage space to contain the materials for the operation of the program.

The toolmobile was constructed by three of the students of the high school industrial-arts department as a project. The basis of the toolmobile was a discarded worktable that was moved out of the home-economics department to make room for more functional equipment. To this cabinet were added a masonite top surface, casters to make the unit mobile, and a large tool panel attached to the rear of the unit. All drawers and doors are controlled by a single bar of metal extending across the bottom part of the toolmobile, making it possible to secure all cabinets and drawers with a single lock. Doors were installed on the front of the tool panel to safeguard the tools.

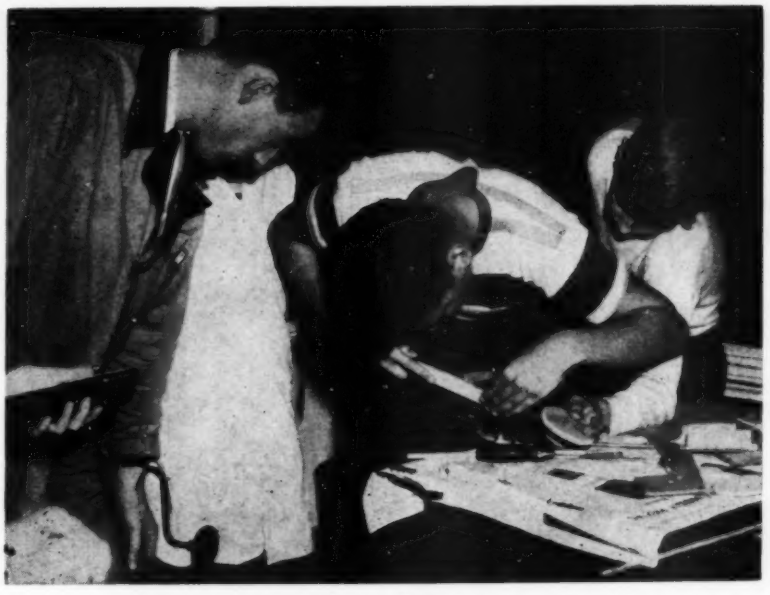
The addition of three spring-type clothes pins to the inside of each door on the front of the tool panel makes handy display areas for motivation and safety posters. All safety posters were adaptations of "Primitive Pete."

Tools are hung on the panel with clips. Tools too large to be hung on the panel are housed in the right hand cabinet of the bench. A red line was painted behind each tool on the panel so that it is a simple matter to tell when all of the tools are in place.

The tools included in the toolmobile are:



The Toolmobile



The instructor aids the students in the construction of their projects

1 clawhammer, 2 mallets, 1 combination panel saw, 1 keyhole saw, 1 hacksaw, 2 coping saws, 1 portable vise, 1 potter's turntable, 1 doz. assorted clay modeling tools, 1 doz. 12-in. rulers, 1 yardstick, 1 marking gauge, 2 X-acto knives, 2 sloyd knives, 1 pair scissors, 1 pair curved tin snips and 1 pair straight tin snips, resharpened to cut cardboard, 1 leather punch for punching cardboard, 1 woodworking brace, 1 set bit stock drills, 2 block planes, 5 assorted files, 2 ½-in. wood chisels, 2 ¾-in. wood chisels, 1 10-in. pipe wrench, 2 paint brushes, 6 small water color brushes, 1 pair side cutting pliers, 1 pair curved nose pliers, 1 countersink, 1 nail set, 1½-in. cold chisel, 6 assorted screw drivers.

The assortment of tools was determined by the need of certain tools for classroom construction. The individual tools were chosen on the basis of the student being able to handle the tool. Those that could not be purchased in the proper size were *home made* by modifying existing tools to fit the students.

Materials in most instances consisted of scrap material obtained from local industry and the high school shop. Such materials included in the toolmobile were: scrap leather, scrap wood, scrap metal, scrap plastics, scrap cloth, string, assortment of nails, assortment of screws, tacks, sandpaper, wire, clay (moist in plastic bag), needles and thread, construction paper, cardboard, shellac (mixed in bottle) with brush and rubber cover, tempera paint, crayons, colored chalk, paste, wood glue, straight pins, craft strip.

In special cases where additional materials were needed, these materials were provided by the classes as a part of the activity where applicable. Students were relied upon to furnish newspaper, cardboard boxes, cigar boxes, and other special materials which they could obtain from home.

The program was set up to meet the following objectives:

1. To provide the students with a medium for expression in mathematics, social studies, language arts, and science.
2. To develop in the students the ability to plan their work and to construct their projects in a satisfactory manner using a variety of construction materials.
3. To foster in the student a desire for worth-while leisure time activity of a constructive nature.
4. To give the students experiences that will help develop a co-operative spirit in working with others either as leaders or as members of the group.
5. To develop in the students an appreciation of beauty and quality.
6. To give the students experiences that will enable them to gain an insight into their abilities as individuals.

The program was inaugurated on October 1, 1950, after a series of meetings with the teachers in which the objectives and scope of the experiment were explained in detail. It was agreed at the beginning of the experiment that only those teachers that felt as if the activities would fit into their classes would use it. No pressure was put on any teacher to use the activities in the classroom. At the beginning 5 of the 14 teachers in the school wanted to share in the experiment.

The teachers indicated their desire to use the program by *signing up* on a blank provided for that purpose in the principal's office, listing their name, room, and the unit being studied. As soon as a teacher made her desire known, the industrial-arts instructor scheduled a conference with her in which the unit was discussed and the projects that could be made in the unit were listed. The teacher then presented the unit to the class and in a discussion with the students let them choose the activities they wanted to construct, being certain that these activities were agreed upon by the teacher and the industrial-arts instructor in the preliminary conference. The list of available projects was determined by the tools and materials available for their construction.

The students then divided the class into committees for the purpose of working on the unit. Each committee was organized for a specific assignment, and each person on the committee was assigned a specific job to do on that project. Thus each student in the class had a project to construct, or a job to perform, and when all of the work was done the class had produced the needed material for a unit.

For example, let us discuss the unit on Colonial Williamsburg:

In conference with the industrial-arts instructor, it was decided that the class could make a puppet show dealing with life in Colonial Williamsburg. This was to be the main project, and each member of the class was given some phase of the main project to construct. As soon as the characters were established in the play, the committee in charge of making the puppets began construction. Each puppet was made to fit the character in the play. A group of girls made costumes for the puppets. Several boys in the room made the puppet theater from orange crates. A group in the class made the scenery, and others made the properties to be used in the play. After all committees had finished, the class presented its play. Thus, through an integrated program of industrial arts, the social studies unit on Colonial Williamsburg came to life for these students.

Each time the industrial-arts period

came due for this class, the toolmobile was rolled into the classroom. Each student put on his work apron and spread newspaper on the worktable or on his desk. The portable vise was clamped on the worktable and the class was then ready to work. The periods lasted 45 minutes with the teacher in the room to work with the industrial-arts instructor on the projects.

The toolmobile was kept in the hall just outside the library and was considered a part of the library. Any teacher in the school could *check out* a tool in the same manner as she checked out a book, and use it in her classroom. The keys for the toolmobile were kept in the custody of the librarian.

The experiment was discontinued on December 1, after a very brief but successful operation. In the two months it was in operation, more than 50 per cent of the teachers in the school had made use of the program, and others were making use of the project method in their classrooms. In reviewing the work, the following suggestions were made for improving the program:

1. Offer an in-service course for the teachers so that they will be better equipped to do most of the construction work on their own.

2. Make available to the teachers more books on the "how-to-do" phase of industrial arts.

3. Establish an industrial-arts laboratory for the elementary students so that they can undertake the production of the larger jobs that arise at times, without cluttering up their own classroom.

The center of classroom activity in elementary industrial arts is the toolmobile

Lighting The Industrial-Arts Laboratory

E. C. HARRISON
Director, Division of Industrial Education
Southern University and A. & M. College
Baton Rouge, La.

Educators are now devoting more of their attention to means of providing effective lighting for classroom purposes. Extensive and intensive research on the part of industry revealed that traditionally accepted lighting standards are woefully inadequate and that lighting conditions tremendously influence the behavior of workers. Educators, motivated by the results of these investigations and sensing the educational significance of lighting, have made and are making studies to discover more effective means for providing proper lighting for classrooms.

Taking into account the results of studies and investigations conducted by industry to upgrade workmanship through improved lighting conditions and the results of studies and investigations made by educators to facilitate the effectiveness of their educational programs through better lighting, the following will present suggestions for providing adequate lighting for the industrial-arts laboratory. These suggestions will be preceded by a brief consideration of the values of proper lighting.

Values of Proper Lighting

Just as proper lighting in industry is essential because of the influence of lighting on the workmanship of workers, proper lighting for an industrial-arts laboratory is essential because of the effect of lighting on the behavior of students and their subsequent development.

1. *Health Values:* Harmon, according to Whitcomb, discovered sufficient evidence in his study of 160,000 elementary school children of Texas to report that improper lighting retards and distorts the physical growth of children. According to Harmon, a student does not see with his eyes, but the whole body comes into play.[1] In an effort to see properly the student adjusts his head, his trunk, and his entire posture to the light situation. Then, too, the human body consumes energy while performing any form of activity. Hence one con-

[1]M. Whitcomb, "Classroom Lighting," *Nation's Schools*, Vol. 39 (May, 1947), p. 35.

sumes energy in seeing. And if the individual is forced to strain his eyes because of faulty lighting he consumes more energy; energy that could be used in performing other activities. In support of this theory, Neidhart states:[2]

It is estimated that a person with normal vision consumes one quarter of his bodily energy in seeing under adequate lighting. If a vision is poor or illumination improper, the consumption of bodily energy is increased considerably above normal.

2. *Safety Values:* It is obvious that the manipulation of machines such as the printing press, power saws, machine lathes, and other power machines requiring close observation demands good lighting, not only for physical values, or for more accurate work, but for safety purposes. Many accidents can be attributed to low or faulty visibility at the time of the accidents.

3. *Promotes Learning:* Classrooms with proper lighting tend to promote learning. Neidhart contends that poor lighting has a bearing on aptitude.[3] Pupils in well-lighted classrooms tend to learn more readily than pupils of like intelligence in poorly lighted classrooms. Many seemingly backward pupils are behind in their studies because of defective eyesight. Putman appropriately sums up the matter as follows:[4]

Research indicates that proper lighting will help in preserving good eyes, aid impaired eyesight, reduce strain and physical fatigue, and increase educational efficiency.

4. *Psychological Values:* It is generally accepted that a pleasant atmosphere is stimulating and inviting. A pleasant atmosphere tends to motivate a response that is characterized by enjoyment. Proper lighting contributes to the pleasantness of an environment. One only needs to compare modern lighting with kerosene lighting for verification of the influence of lighting on the pleasantness of an environment.

Stimulating Effects of Good Lighting

If the idea that an attractive and pleasant environment is stimulating and that proper lighting contributes to the attractiveness of an environment is accepted, it follows that good lighting is stimulating. Consequently, proper lighting in an industrial-arts laboratory will stimulate activity on the part of the students.

In view of the values of lighting as previously discussed, the following statement is offered as a criterion: *The lighting of an industrial-arts laboratory should be adequate enough to reduce eye fatigue to a minimum, thus promoting safety and stimulating learning.*

To provide lighting for an industrial-arts laboratory so as to reduce eye fatigue, to promote safety, and to stimulate learning necessitates giving attention to the significant factors involved — artificial lighting, natural lighting, walls, ceilings, floors, and equipment.

1. *The general lighting for an industrial-arts laboratory should have the minimum intensity of thirty foot-candles.*

Mays advocates a minimum of 12 to 15 foot-candles of illumination on work surfaces and 18 to 25 foot-candles on drawing tables.[5] Differing slightly with Mays, Newkirk suggests 12 to 14 foot-candles on work benches and 16 to 18 foot-candles on drawing tables.[6] Recent studies have led the writer to raise the suggested minimum figure for adequate lighting to 30 foot-candles. This suggestion is supported by Birren who recommends a general illumination of 30 foot-candles for classrooms.[7]

Making Lighting Effective

For lighting to be effective it must be well diffused or evenly distributed. To diffuse artificial lighting it is advisable to use indirect lighting fixtures of fluorescent lighting. To obtain proper diffusion of natural lighting, the windows of the laboratory may be covered with white fabric stretched on a wood frame. When possible it is better to use prismatic glass blocks instead of conventional windows.[8]

2. *Ceilings should have a reflectivity of 70 to 85 per cent.*

The effectiveness of natural and artificial lighting is to a great extent dependent on the reflectivity of the ceiling. It has been commonly known that a dark ceiling decreases the effectiveness of lighting sources. Thus the practice has been to paint the ceiling with light colors. In accordance with this idea, Paul advocates painting the ceiling with colors that would enable it to reflect from 65 to 75 per cent of the light that strikes it.[9] Russell Putman recommends a ceiling reflectivity of 80 per cent.[10] The "Harmon Technic" suggests a reflectivity of 85 to 90 per cent.[11] Hence, it seems that the suggestion that ceilings in industrial-arts laboratories reflect 70 to 85 per cent of the light that strikes them is justifiable and appropriate.

3. *Walls should have a minimum reflectivity of 60 per cent.*

To prevent the possibility of excessive glare, the walls should not have a reflectivity equal to that recommended for ceilings. Birren advocates walls that reflect from 60 to 70 per cent of the light that strikes them.[12] The writer, however, accepts Paul's recommendation that walls for classrooms have a reflectivity of 60 per cent.[13]

To eliminate excessive glare and to provide for pleasant contrast, it is recommend that walls be painted with hues of green and blue with reflectivity of about 60 per cent. Birren,[14] however, recommends hues of blue-green or peach for walls and Thompson[15] suggests shades of green for side walls and soft yellow or suntone for end walls.

4. *The brightness ratio of the whole visual field of an industrial-arts laboratory should not be greater than 10 to 1.*

It has been the common practice to paint classroom walls white or buff and paint the trim with dark oak or brown paint. Such color scheme has a brightness ratio that produces a great strain on the human eye. Expressing his objection to a very dark and light contrast, Harmon advocated a brightness ratio of three to one.[16] Harmon further states:[17]

Brightness Ratio Should Be 3 to 1

Ultimately, failure to come within the tolerance of this brightness ratio means that the skeletal, biochemical, and psychological nature of the child is disturbed.

It was demonstrated in Texas by Harmon that when children were doing close visual work they experienced trouble when any area in the field of vision is more than three times brighter than the brightness of any other visible area.[18]

Expressing his views on the significance of brightness ratio, Paul states:[19]

---

[2]J. M. Neidhart, "Protect Their Eyesight," *Nation's Schools*, Vol. 34 (Oct., 1944), p. 34.
[3]*Loc. cit.*
[4]C. Putman, "Modern Trends in School Lighting," *Nation's Schools*, Vol. 39 (May, 1947), p. 44.
[5]A. B. Mays and C. H. Casberg, *School Shop Administration* (Milwaukee: The Bruce Publishing Co., 1943), p. 23.
[6]L. V. Newkirk, *Organizing and Teaching the General Shop* (Peoria: The Manual Arts Press, 1947), p. 95.
[7]F. Birren, "Functionalism With Color," *Nation's Schools*, Vol. 39 (May, 1947), p. 41.
[8]Whitcomb, *op. cit.*, p. 37.
[9]Hugh Paul, *Daylight in School Classrooms* (Chicago: R. R. Donnelley and Sons Co., 1947), p. 8.
[10]Pitman, *op. cit.*, p. 44.
[11]Whitcomb, *op. cit.*, p. 38.
[12]Birren, *op. cit.*, p. 43.
[13]Paul, *op. cit.*, p. 8.
[14]Birren, *op. cit.*, p. 43.
[15]J. C. Thompson, "Color in the School Shop," INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, Vol. 36 (Mar., 1947), p. 100.
[16]Whitcomb, *op. cit.*, p. 36.
[17]*Loc. cit.*
[18]*Ibid.*, pp. 35–36.
[19]Paul, *op. cit.*, p. 4.

Well-Lighted Activity Rooms
East High School, Denver, Colo.

Photographs courtesy of General Electric Company, Schenectady, N. Y.

DRAFTING ROOM

HOME-ECONOMICS ROOM

WOODWORKING SHOP

RUGMAKING SHOP

If the brightness contrasts are low, one will see with comfort; if they are high, of the order of fifty or one hundred to one, as they often are, the eye will find it difficult to do its job without fatigue and eventual injury.

Although it is desirable that the brightness ratio not exceed three to one, it is most difficult to maintain such a ratio in an industrial-arts laboratory. For example, it would be difficult to maintain a floor for an auto laboratory that would reflect not less than 25 per cent of the light that strikes it, especially if wood blocks are used for the floor. Consequently, it would be desirable for an industrial-arts laboratory that the brightness contrast of the visual field not exceed 10 to 1.

If one commits himself to having an industrial-arts laboratory with brightness ratio of not greater than 10 to 1, it means that in addition to having a color scheme as suggested in sections 1 and 2, the machinery should be painted so as to produce the desired brightness tolerance. Most of the equipment, since it is usually put on the market in various colors such as reds, blues, and greens, must be refinished to be consistent with desired brightness tolerance.

By way of summary, it is essential that industrial-arts teachers give serious attention to the matter of providing adequate lighting for their industrial-arts laboratories, especially since it has been demonstrated that the development of students is influenced by the quality and quantity of lighting provided for them to work by.

Outline of Proposed Activities For Fundamentals of Electricity

F. E. ROBINSON
State Teachers College
Oswego, N. Y.

In order to make the fundamentals of electricity practical and interesting to the student we must consider him as a future consumer. To accomplish this goal we must consider the areas where people encounter electrical appliances in everyday living. Since we are making no attempt to train electrical engineers, electrical technicians, or electricians, the more technical phases of electricity are omitted to a large extent.

The areas where electricity is used daily by the majority of people can be limited primarily to electrical equipment and appliances used in the home, and the electrical system of the automobile.

In addition, source and distribution systems should be discussed and studied in order that the individual can better understand some factors involved in getting electricity to him as a consumer.

The basis of the work to be done on each topic of the following outline assumes that a working model of each type of equipment or appliance is available for observation and study.

A. Safety
   1. Safe installation practice
   2. Proper maintenance
   3. Safe practice in using electrical equipment

B. Insulating and conducting properties of materials
   1. Common conductors and insulators
   2. Electrolytes

C. House wiring. The framework of two rooms should be constructed so that actual wiring procedures can be done by the student.
   1. External wiring
      a) Distribution transformers (discussion)
      b) Three wire service entrance (230–115)
      c) Meters
         1) Meter installation
         2) Meter reading
         3) Correct voltmeter and ammeter connections
   2. Internal wiring
      a) Fuse boxes
         1) Cartridge fuses
         2) Plug fuses
      b) Roughing in wiring
         1) Bx, romex, lomex, open wire
         2) Correct size and carrying capacity of wire
      c) Convenience outlets
      d) Light outlets
      e) Switches
         1) Snap switch
         2) Three way switch
         3) Four way switch
      f) Special appliance outlet
         1) Wire sizes
         2) Special plugs
   3. Inspection methods — correct procedure
      a) Underwriters' specification and interpretation
      b) State specifications

D. Discussion topics. These topics are included to give the students some idea of the whole field of electricity and to point out some of the vocational possibilities involved in electrical work.
   1. Electric power generation
      a) Hydroelectric
      b) Steam turbine
      c) Gasoline and diesel turbines
      d) Motor generator
   2. Transmission and distribution systems
   3. Industrial uses
      a) Carbon arc furnace
      b) Resistance furnace
      c) High frequency heating

E. Electrical home appliances

The assumption is made that a working model of each appliance is available for complete examination by the student, so that each student could take it apart and reassemble it. The electrical parts need not be rebuilt in all cases.
   1. Extension and appliance cords
      a) Correct attachment of cap plug
      b) Correct attachment of socket
      c) Underwriters' specifications
   2. Heating
      a) Electric stoves
      b) Toasters
      c) Coffee maker
      d) Grill
      e) Electric iron

f) Space heaters
3. Motors of types used in refrigerators, washing machines, vacuum sweepers, waxers, ironers, dishwashers, fans, and food mixers should be studied
   a) Split phase motors
   b) Capacitor motors
   c) Repulsion type motors
   d) Polyphase motors
   e) Universal, shaded pole, and fan motors
   f) Synchronous motors
   g) Alternating-current motor control
4. Signal systems. Installation and study of construction of each type.
   a) Bells
   b) Chimes
   c) Annunciators
   d) Burglar alarms
   e) Bell ringing transformers
5. Telephone
   a) Transmitter
   b) Receiver
   c) Types of connections
6. Radio
   a) Transmitter
   b) Radio waves (discussion)
   c) Receivers
   d) Record players
   e) Transcribing machines
7. Electrostatic appliances
   a) Air cleaners
   b) Thermostatic furnace control

F. Automobile electricity. This again involves the study of actual working models as well as the complete system.
1. Six-volt batteries
2. Generator
3. Distributor
4. Condenser
5. Fuses
6. Spark plugs
7. Induction coil
8. Relay
9. Wire sizes and types
10. Voltmeter and ammeter connections
11. Lights

G. After each of the above areas has been properly studied and investigated, an opportunity should be given to each student to choose one or more areas to investigate further according to his own particular interest. To accomplish this, materials should be provided for the construction of some electrical project that would be of use and value to the student making it.

Basic Photography Course

HARRY A. GOLDSTEIN
Instructor of Photography
Senior High School
Tucson, Ariz.

The art and practice of photography offers a vast resource in the vocational, cultural, and personality development of students in high school and adult evening school programs. Photography stands on the front line of the communication arts. It is a modern symbol of our visual age. Many new time-saving techniques and jobs have been introduced through photography. Photography has sufficient motivation to add to any industrial arts, vocational, or adult program. Properly organized it may be part of the regular curriculum or the school activities program. The growth of photography in our schools even to the conserva.ive has been amazing. For the many teachers and school executives whose schools are already teaching photography, and for those who are thinking of adding photography there is need for guidance. There is also need for an exchange of experiences and ideas.

In response to requests concerning a course in basic photography the following is submitted. This course will be especially valuable for people engaged in selling photographic materials, and for those who would like to enter this field. It will be useful to those who desire to learn the fundamentals of photography. This course is based on the needs of most amateur photography. As a vocation photography is one of the most interesting and profitable professions. As a hobby it is second to none.

The course is planned, as far as possible, so that the different lessons follow in logical order, and one subject will lead up to another. The demonstration-lecture form of instruction, and learning by doing form the core. As each unit problem is introduced it will be followed by a lecture and demonstration. The students will immediately put into use their newly acquired knowledge during the workshop periods on the unit problem.

OUTLINE OF THE COURSE

Meeting — *Unit Problem*

1. To learn how to operate and use correctly the camera and exposure meter.
2. Workshop
3. To learn how to make a contact print, and to determine the correct grades of paper for the different types of negatives.
4. Workshop
5. To learn the chemistry of photography. How to mix solutions correctly and the purpose of each chemical in making good negatives and prints.
6. Workshop
7. To learn how to develop film correctly using two of the popular types of developer.
8. Workshop
9. To make a photograph of a black and white subject such as a chart, map, or printed page.
10. Workshop
11. To learn the effect of the aperture (f: stop) upon the depth of field in a photograph.
12. Workshop
13. To learn how to make a good enlargement.
14. Workshop
15. How to save a negative by intensifying, reducing, and retouching.
16. Workshop
17. How to make a simple portrait with one light.
18. Workshop
19. How to make photographic Christmas cards.
20. Workshop
21. To study the effect of different filters on various colors.
22. Workshop
23. How to use supplementary lenses.
24. Workshop
25. How to copy a photograph having continuous tones.
26. Workshop
27. To learn how to use artificial lighting to produce pictures that are interesting and forceful.
28. Workshop
29. To learn how to make good pictures using sunlight and flashbulbs, and by flashbulbs only.
30. Workshop
31. To learn how to make good photographs using the high speed strobolight and the problems of strobolight photography.
32. Workshop
33. The last four meetings will be workshop
34. periods. The student may endeavor to improve
35. any of his previous efforts, or to work on a
36. personal project under the supervision of the instructor.

Course of Study for the Graphic Arts Shop

JOHN M. FONTANA
Somers Junior High School
Brooklyn, N. Y.

Shop teachers must ever be on the alert to the changes going on about them. In order to meet these changes, the content and practices in industrial arts must be kept constantly in a stage of transition and experimentation. There can, therefore, be no fixed course of study. To meet the trends in graphic-arts activities, it may assist the printing teacher to study the following course outline which is applicable to junior high school, senior high school, or college level.

First Year

1. Introduction
   Safety test
   Notebook
2. Equipment in the Graphic Arts Shop
   California job case
   Kinds of cases
   Learning lay of case
   Learning cap section of case
3. History of printing — Part 1
   Composing stick
   Learning lower-case
   Drill line — caps
4. History of Printing — Part 2
   Quads and spaces
   Drill line — caps and lower-case
5. Envelope corner card
6. Learning other divisions of type case
   Calling card
7. Four demons
   Identification card
8. Project: "Book of Proverbs"
   Discuss procedures and working operations to class.
   a) Picture of Franklin
   b) Franklin's autograph
   c) Title page
   d) Introduction
   e) Proverb pages (ten or twelve)
   Printed impression of picture of Benjamin Franklin to be made from linoleum by the individual student, and used as an insert in the "Book of Proverbs."
9. Lockup
10. Linoleum block (choice)
11. Print linoleums on Pilot press.
12. Make a simple pad with name heading.
13. Spiral bound memo book
14. Simple dry-point etching
15. Group project:
    Birthday card
    Get-well card
    Greeting card
    (Thermography process may be used with any one of these projects.)
16. Setting a flush paragraph for newspaper or magazine
17. Suggested projects (student's choice)
    Telephone pad
    Announcement
    Admission ticket
    Club card
    Party invitation
    A useful piece of printed material
    Illustration for a book plate (linoleum)
18. *"The First Cartoon,"* a group project consisting of linoleum block, art work, typesetting, lockup, and press feeding

Second Year

1. Safety
2. Setting a flush paragraph as for newspaper or magazine
3. Setting an identification card
4. Setting a personal calling card
5. Linoleum block
6. Lockup
7. Setting an indented paragraph
8. Setting an overhanging indention
9. Setting an inverted pyramid

(The above three paragraphs to be written by the student covering the following topics: sports, hobby, current events. Copy to be corrected by the English teacher.)

10. Student's choice:
    a) "The Printer's Devil — How It Began," a booklet with pictures, made from linoleum, type, presswork, and binding
    b) Useful piece of printed material
    c) Spiral bound memo book
    d) Setting and printing a "First Aid Booklet."
11. Dry point etching
12. Making a sheet of paper
13. Spiral bound scrapbook for recipes
14. "Mother Goose Nursery Rhymes" with silk screen cover, linoleum blocks for illustrations, type, presswork, and bindery

Group Project: Yearly calendar

Third Year

1. Safety
2. Announcement
3. Poetry
4. Menu
5. Binding a photograph album with loose leaf sheets, setting and printing, or lettering, an appropriate title on top cover
6. Case-bound scrapbook with printed headings of school activities
7. Students' choice:
   a) Printing and binding a case-bound book. Subject: An anthology of students' poems or stories as selected by the English department.
   b) Graduation news or highlights
   c) Memo book, spiral bound
   d) Print 25 of each on press: personal calling cards, noteheads, envelopes
8. Dry point etching
9. Setting and printing a bookmark
10. Silk screen work
11. Linoleum block
12. Papermaking

Group Project: Hard covered, bound book with illustrations and type "Poor Richard's Almanac."

First Term Talks

Introduction
Safety
Equipment
History of Printing

Johann Gutenberg
Story of Type
Four Demons
Ligatures
Benjamin Franklin
Type Measurement (the point system)
Proofreading
Paper
Consumer Information
Progress in Graphic Arts, and recent discoveries and inventions
Occupational information

Brief Talks for Second- and Third-Year Students

(Students to receive printed supplements)
The importance of graphic arts
History of the graphic arts
The three major printing processes
How pictures are reproduced in printed form for newspapers, magazines, and books
The daily newspaper
The billboard poster
Binding of books
The first papermaker
Hand-made paper
Manufacture of paper
Kinds of paper
How foundry type (hand-set) is made
Typecasting machines
Printing inks
Printing rollers
Printing plates
Four- and five-color process printing
Decalcomania printing
Consumer interest
Occupational information
New Processes: typesetting, presswork, allied branches
Newest trends in graphic arts

ASSIGNMENTS

First Year

History of Printing

From Cairns up to and including the time printing was introduced in North America by Stephen Daye.

John Gutenberg

1. His youth
2. How the idea of making movable type introduced itself
3. His trials, tribulations, and perseverance while conducting his experiments
4. A dream comes true. Explain how he succeeded in accomplishing his invention.
5. What were his first works? What followed?
6. What happened to his shop? How did he spend his old age?
7. What have you gained from reading "Wings for Words"?

Benjamin Franklin, Printer

1. Where he came from
2. His apprenticeship
3. Success as a printer
4. How "Poor Richard" began
5. His other fields of accomplishment
6. Why is he called the "Patron Saint" of American printers?

Practical Assignments (choice of two)

1. Cuneform tablet
2. Writing quill
3. Wood block (letters of alphabet)
4. Fifteenth-century type printing press

Second Year

Origin and Development of the Alphabet

1. The romantic background
2. Trace the steps leading up to the alphabet as we use it today.
3. Illustrate one or two symbols in various stages of development to its present letter of the alphabet

The Daily Newspaper

1. Follow the news from department to department. Explain the important steps.
2. Linotype
3. Composing
4. Matrix
5. Stereotype
6. Presswork
7. Distributors

How Paper Is Made

1. The raw material
2. Where the raw material is found
3. The steps used in making paper
4. The Fourdrinier machine

Printing Inks

1. What goes into the manufacture of inks?
2. Sources of the raw materials used in making inks
3. How inks are made
4. Kinds of inks for different processes
5. Kinds of inks for different quality paper

Third Year

Color in Printing

1. What is the advantage of printing in color?
2. How many colors are used for a complete color picture as illustrated in fine books and magazines? List them in sequence.
3. Explain how this is done.

The Three Major Printing Processes

1. How letter-press printing began
   How lithography began
   How gravure began
2. Explain how each process operates.

Consumer Information

1. How does the Graphic Arts rank in the industries of our country?
2. In United States industry?
3. Give some statistics.
4. Why is it an important industry?

Employment Opportunities

1. List as many jobs as you can. Divide your listing into three divisions: administrative, shop, sales. Describe briefly what each job requires. Select a position you would like and explain the reason for your choice.

Suggested Projects

1. Linoleum block and printed material for Halloween
2. Linoleum block and printed material for Thanksgiving
3. Dry-point etching of Christmas scenes
4. Chanukah cards printed in thermography
5. Christmas greeting cards printed in thermography
6. Printing yearly calendar
7. Observance of National Printing Education Week and Benjamin Franklin's birthday with appropriate exercises and assembly
8. Silk screen and printed brochure for Lincoln's and Washington's birthdays
9. Valentine's Day cards
10. Printed material and linoleum for Passover
11. Silk screen cards for the Easter holiday
12. Mother's Day cards
13. Printed piece for Memorial Day
14. Father's Day cards
15. Printed piece for Flag Day
16. Birthday cards
17. Poor Richard's Almanac
18. Dry-point etchings on hand-made paper
19. Bookplate printed from linoleum
20. Bound photograph album for graduating class
21. Spiral bound recipe book (for gift purposes)
22. Case-bound school scrapbook

BIBLIOGRAPHY

"Printing and the Allied Trades" — Karch
"General Printing" — Cleeton and Pitkin
"The Graphic Arts" — Johnson and Newkirk
"Exploring the Graphic Arts" — Marinaccio and Osborn
"The Practice of Printing" — Polk
"Wings for Words" — McMurtrie
"The Autobiography of Benjamin Franklin"
"Graphic Arts Crafts" — Kaufman

TRIPS AND EXCURSIONS

Printing plant where the work is executed by three major processes

Linotype plant
Monotype plant
Electrotype plant
Ink plant
Metropolitan newspaper
Library and museum

FILMS

"Magazine Magic." Story of the Curtis Publishing Co. It shows everything from the planting of pulpwood seedlings to the delivery of finished copies. 16mm., sound, color, 40 min. transportation, Princeton Film Center, Princeton, N. J.

"The Gift of T'Sai Lun — Paper." Showing the original Chinese method of paper making compared with modern methods of manufacture. 16mm., sound, black and white, 35 min. Transportation, B. J. Delaney, Hammermill Paper Co., Erie, Pa.

"Serving the Graphic Arts." The manufacture of ink through each step of the process from the raw materials to the finished product. 16mm., sound, transportation via express. Mrs. Anne Drummond, Sinclair and Valentine Co., 611 West 129 St., New York 27.

"Bound to Last." Tour of the huge plant in which the government printing is done. Shows how books are made, from manuscript to bound volume. Explains proofreading, typesetting, printing, binding. 16mm., sound, 15 min. The Institute of Visual Training, 40 E. 49 St., New York 17.

"Trees to Tribune." The production of a metropolitan newspaper involving three major activities — gathering of the pulpwood, making the newsprint, and printing the news. 16mm., black and white, sound, 3 reels, rental 50 cents. Bureau of Visual Education, Mr. Frank S. Montgomery, Lawrence, Kans.

* * *

The following films listed are from United World Film, Inc., Larchmont, Chicago, Ill.

"Linoleum Block Cutting and Printing." Every step in cutting and printing. 16mm., silent, rental $1.50, 15 min.

"Dry-Point." A demonstration with comparison of processes of etching and wood engraving. 16mm., silent, rental $2, 30 min.

"Silk Screen Process." From the original drawing to the color sequences. 16mm., silent, rental $1.50.

"Making the Funnies." Each step of the artist's dream from the drawing to the printing. Well-known artists at work. 16mm., sound, rental $1, 11 min.

Basic Vocabulary for Painters and Decorators

ERNST H. SUERKEN
Supervising Principal
Union Free School District
Greenburgh Number Eleven
Dobbs Ferry, N. Y.

alcohol
aluminum
amalgamator

A
American
aniline

B
bathroom
benzine
bleaches
bleaching
bloom
brick
bronze
bronzing
brushes
burnishing

C
cabin
calcimine
canvas
casein
calking
ceiling
cellar
cement
cleaning
closet
color
composition
copper
crack
creosote

D
decalcomanias
decorating
decoration
decorative
dipping
driers
dropcloths

E
enamel
enameling
English
estimating
extenders

F
fillers
finishes
finishing
fire-retardant
flocking
floors

garages
gilding
glass
glaze
glazing
gloss
formulas
French
fuming

G
gold leaf
Gothic
grain
grainer's comb
graining

heart grain

H
home

I
interior
iron

J
Japan

K
kitchen
knives
knots

L
lacquer
ladders
lining
linseed oil
lithopone

M
marble
marbling
marine
masking
masking tape
masonry
matching
metal
mildew
mineral
mixing
modern

O
oak
oil

P
paddle
paint
patching
pigments
planks
plaster
plywood
polish
polishing
porcelain
preservatives
primers
priming

R
radiators
rugs

S
sanding
scaffolding
shellac
shingles
smooth
smoothing
spackle
spar varnish
spontaneous combustion
spray guns
spraying
staining
stains
stencils
stippler
striping

T
tables
texturing
thinners
tools
toys
trestles
turpentine

U
undercoater

V
varnish
varnishing

W
wall flats
wallboard
wallpaper
wallpapering
walls
washing
wax
white-lead
whitewash
wood
woodwork

Analysis of Model Aircraft Construction

ROBERT R. LYNCH
Graduate Student
The Stout Institute
Menomonie, Wis.

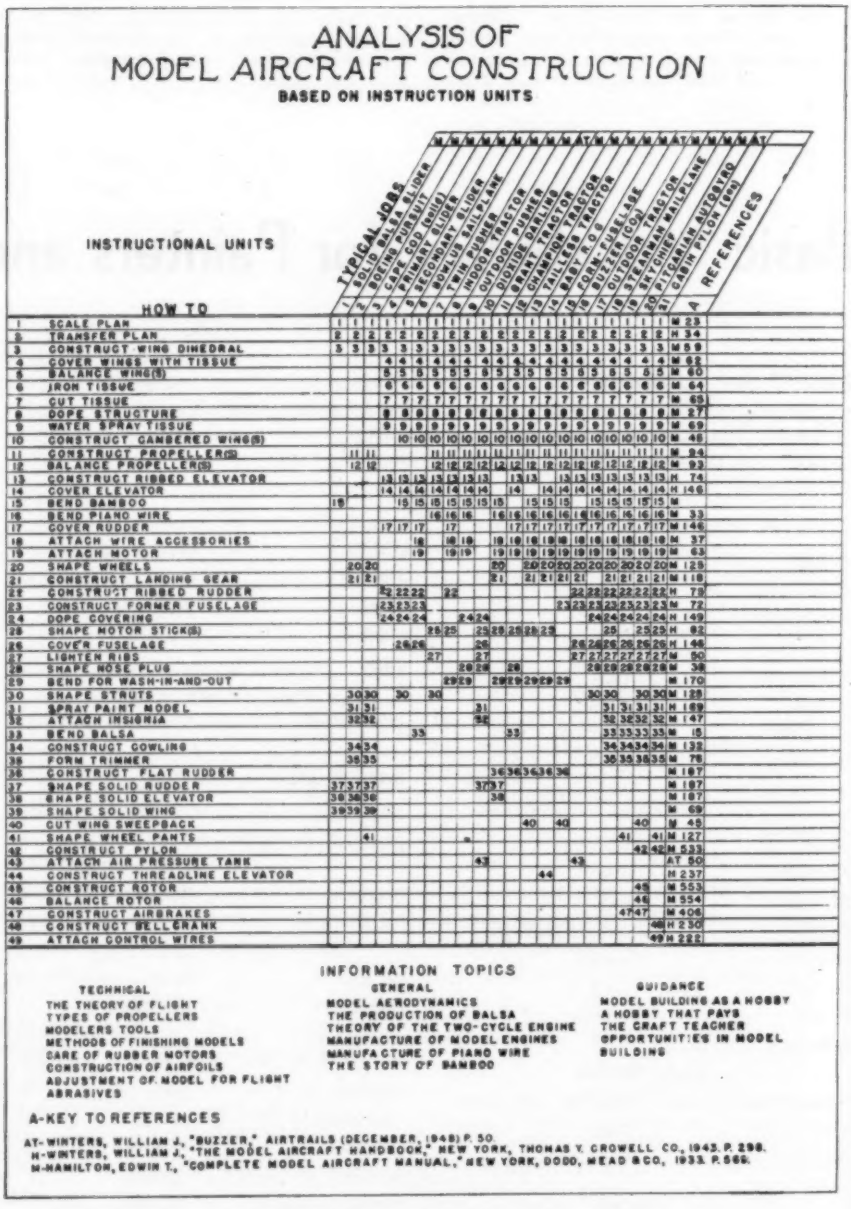
Occasionally the industrial-arts teacher is called upon to teach an activity foreign to his regular classwork. One of the best methods of approaching this type of a problem is the analysis of the subject. The accompanying analysis chart may be used to determine the units of study to be included in a course of study in model-aircraft construction. Most subjects may be broken down into their instruction and information units, as has been done in this analysis.

The typical jobs chosen in this analysis progress from the most simple to the most difficult, or from the jobs with the fewest operations to jobs with many operations. Each job is referenced by a letter at the top of each column, and the references are keyed at the bottom of the chart.

The instruction units are not numbered in order of progression in the construction of each project, but, rather in accordance with the frequency with which they occur. The first instructional unit is necessary in all jobs, the forty-ninth unit occurs in but one job; the most complex job in the analysis. Each instruction unit is keyed to the references in column *A*. This column indicates the page number of the source and is keyed by letters at the bottom of the chart.

The column on the extreme right of the chart may be used for remarks or for the numbers of the demonstrations to be given to the class for each instruction unit.

Information topics are divided into three categories: technical, general, and guidance information. Technical information includes those elements absolutely necessary to the completion of the job. General information is nice to know, but not absolutely necessary to the completion of the job. Guidance information indicates the vocational or avocational aspects of the subject being analyzed.



Analysis of model aircraft construction

When the teacher has thus analyzed the subject matter to be taught, the construction of a course of study is a comparatively easy matter.

Evaluation in Electricity

ALAN R. PAWELEK
Chairman, Industrial Arts
Western Washington College of Education
Bellingham, Wash.

One of the principal difficulties in the teaching of electricity is the dearth of suitable, interest-motivating projects. An electrical project, as such, is almost nonexistent. Those that are made in the school shop usually consist of a coil, an extension cord or a lamp circuit. The remainder of the project, which actually is the only part that requires manipulative skill of some degree, is fabricated from metal or wood. In the majority of cases, then, the student is graded upon his ability in areas other than electricity. The knowledge accrued in the latter can be evaluated, in general, only through oral and written performances.

The following contains a description and examples of the evaluative procedures used by the writer in his teacher education classes:

The *oral* technique may take the form of a verbal test, a class report or a student demonstration. Of the last two mentioned it has been found that the demonstration method is the more valuable to the class and to the individual. The student will learn well at least one phase of electricity and the group is motivated by some interesting phenomenon happening before its eyes. The electrolysis of water, electroplating, a simple wet cell, the principle of induction, of motors, and of generators are some of the more interesting demonstrations that students can perform.

Unless it is presented by a superior student the class report is of little value to the group. The individual receives valuable experience by organizing his talk and speaking to his peers. He must necessarily do some reading and research. This is good for him but, in general, it is a waste of class time. Seemingly, here is a paradox. On the teacher education level our products have been criticized for a lack of oral ability. The criticism is valid. We do *not* allow individuals sufficient opportunities to speak or lead discussions. Let us digress a moment. How does a shop teacher do most of his teaching? By demonstration, either group or individual, does he not? Then why not allow him to practice this demonstration technique to good advantage? At the same time the class will derive more benefit than by listening to words alone. The student, meanwhile, must do some speaking and in many cases a good discussion will follow. In these instances if the instructor will assume the role of a student or stay out of the discussion entirely, better results will probably be obtained. Many class activities are dominated by the teacher to too great an extent.

If one has never been disillusioned by his teaching or by his students (almost an improbability) attempt the following experiment. It may be a revelation as to how many facts any member of a group will absorb through a lecture and/or demonstration. Take any simple series of related materials, for example, the laws that apply to a parallel circuit. Demonstrate the circuit, define it. With an ammeter and voltmeter indicate that:

1. The voltage drop across any path is equal to that of the source.
2. The total amperage is equal to the sum of the individual amperages.
3. The total resistance is less than the smallest resistance in the circuit.

Without telling the group that a verbal test will be given, teach the fact in the best manner you know how. Now, ask the students to construct the circuit. Upon completion, ask any individual to demonstrate and repeat any of the facts which you so patiently attempted to teach. It will be a most unusual student, taught by a most unusual teacher, who will be able to describe the circuit and its fundamental laws.

What conclusions can be drawn from the example given above? Based upon the laws of learning, the following principles may well be considered:

1. Facts, in themselves, are soon forgotten.
2. The application of *principles based on facts* is important.
3. The student should know the basis upon which he will be evaluated.
4. The student should know the type of evaluation which will be utilized.
5. The student should be given opportunity for review and repetition.

If further proof is needed, repeat the experiment with another group. This time apply the laws above — allow the student to work with his circuit, explain the principles involved, and tell him the nature of the examination. The outcomes will be far different! It seems that shop teachers are too prone to forget the old axiom that *telling*, *showing*, and *doing* are necessary to good instruction.

The *written* performances are evaluated through term papers and tests. The former are not required but are suggested for those individuals who desire to delve further into the subject. Extra credit is given for such work in the same manner that a student receives an increment for a skill project above the minimum requirements. Some topics which have been written upon as term reports are: history of the incandescent lamp, the Voltaic cell, electricity in medicine, the generation of current, and, negative or positive? The latter was an interesting discussion of the old and new theories of current flow.

The written examinations are not too frequently given. At the most, they are administered only at the conclusion of important units. This occurrence takes place at not less than four-week intervals. On the whole, the tests are an attempt to teach basic facts as they apply to general principles. The following are a few ex-

amples of questions taken from unit tests:

1. Diagram a complete circuit which will indicate how one lamp on a stairway could be controlled.

2. A 4 volt lamp is to be connected across a 6 volt battery. Diagram the circuit showing the necessary resistor. What is the necessary voltage drop across the resistor? With a current of .5 of an ampere flowing, what must the resistance of the resistor be? What is the resistance of the lamp?

3. On No. 6 dry cells, the *load* should not exceed 5 amperes continuously at 1.4 volts. How many cells are needed to supply a steady current of 30 amperes at 5.6 volts? Diagram the cells' connections.

4. Which has the more resistance — a 60 watt or 100 watt lamp?

5. Explain the operation of a transformer. Use any sketches which may seem desirable.

As can be readily surmised, the preceding questions are somewhat thought-provoking. Principles must be applied in order to find the correct solutions.

The written examination is never given for the sole purpose of evaluating the student. It is primarily a teaching device. Consequently, at least one class period is given over to its discussion after the papers have been graded. It is felt that these discussions are at least as valuable, if not more so, than the actual performance on the examination. Because of this philosophy not too much weight is put upon the *final* which falls upon the last day of the term.

The written examination is promulgated from the objectives of the course, the attainment of which are attempted through the various activities described in the foregoing. Manipulative skills are included in these activities. But a premium is not placed upon these skills to the same extent as in areas other than electricity. An attempt is made to motivate students to experiment, to develop ideas, and to do research. However, a student usually associates a well done, completed project with a better *grade*. Therefore, he will take the path of least resistance and make something for which plans have already been drawn. This is not intended to be an indictment against such plans. They certainly have their place and in many instances are a real help to both student and teacher. If utilized correctly, they will serve as a guide — a starting point from which other designs can be made. This is their *real* value and, generally, the better-than-average student will take advantage of the opportunity afforded him.

The premium, then, is not upon how *well* a task has been done, but rather upon *what* has been done or attempted. The viewpoint expressed in the first paragraph concerning projects is carried over to the evaluating procedure. For example, a student may not have produced a single, tangible form during the term but has experimented with a new idea in radio or with better power development. He has learned some laws and applications — often in a negative manner, to be sure. He, necessarily, must have done extra reading and research. In other words, he was learning *electricity*. The student is evaluated accordingly and *not* upon how well a wooden base for an electromagnet has been made and finished.

It is assumed and agreed that there is some subjectivity in any evaluation no matter how objective the instruments of appraisal seem. A concession is made, herewith, that a teacher-judgment of a student through the principles outlined above, is subjective to a large degree.

With this belief in mind, the writer invites the reader to forward any suggestions for improvement which may be used experimentally in laboratory school or teacher education classes. Where nation-wide conferences on the subject are difficult to arrange, the type of interschool communication suggested may prove mutually advantageous to our students.

Film Projector Operation in General Shop

ROBERT W. INNIS
Superintendent of Schools
Williamsburg, Mich.

Frequently smaller schools without fully established visual education departments are faced with the problem as to who will operate and care for the projection equipment.

It is very difficult for teachers to operate the projector, as their time is usually concerned with discipline, seating, and class management. It is a fact that the equipment gets better care, service is better, and the film breakage is less when a few capable, responsible, and interested students have charge of the projection operation. Student help can be trained to handle all of the equipment so that the teacher's time is free for class management alone.

In order to get good projectionists, a short course can be organized within the general shop class and correct methods of maintenance and operation can be taught. Class membership should consist of volunteers and each should feel free to drop the course if they should decide that they don't like the work. It should be made clear to all that only those boys who like to do the work and want to do it are the ones wanted in the class. If sophomores and juniors attend the class, they will be able to give more and better service to the school than would seniors who would be gone the following year.

Much of the course of study can be taken from the operation handbook of the machine, but the course content should be

broadened to include theory, operation, care, and maintenance of all of the equipment.

Students who successfully complete the course and have made from three to five showings by themselves may be given a certificate of achievement. A certificate such as shown in Figure 1 is a strong incentive to complete the work successfully. It can be typed or printed on a convenient billfold size card (2½ by 4 in.) and can be retained as a permanent record of achievement by the student.

Such a certificate might help a student get into projection work after graduation if he cared to; mainly, in college, armed forces, or with some company where such qualifications are essential.

Student's Photograph

Williamsburg
Consolidated Schools

This is to certify that

John Doe

is qualified to operate the 16mm. Ampro motion picture sound projector and the 35mm. slide-film projector.

R. W. Innis
Sup't. Signature

Fig. 1

Twins, Although Not Identical

SYLVAN A. YAGER
Chairman, Department of Industrial Arts and Trades and Industry
State Teachers College
Terre Haute, Ind.

Industrial education has reached maturity. It is accepted as an important part of modern, functional education programs in schools in every state.

We have become increasingly aware of the importance of technology in our society. We accept and depend on it as a part of our everyday living. With industry expanding every day and with a better understanding of the importance of industry as a factor in our democratic social order its influence in education now extends from the first grade through and beyond the high school.

But just what is this new educational area? Broadly speaking industrial education is any form of education that is primarily concerned with the materials, tools, processes, products, and problems of industry. It is important that we recognize and understand the fact that there are two distinct forms or types of industrial education.

Industrial-arts education is the type of industrial education that is offered essentially for its general educational value. It is very broad in scope and it is included in all grades and high school for both boys and girls. It is in reality a curriculum area rather than a subject or course, being comparable in this respect to the language arts.

In industrial arts the learners are provided with a broad range of experiences involving the use of many tools and materials. Certainly some skill is required but the primary concern here is the growth and development of the pupils with emphasis on appreciations, attitudes, and understandings.

The emphasis and standards and types of work will change, of course, as pupils advance through the grades and high school. At no point, however, will the work in industrial arts be organized for specific training in any one kind of work or subject primarily for occupational training or preparation for a trade. Speaking very frankly, however, in some schools, in the absence of an industrial-vocational education program a good industrial-arts education program is the nearest offering provided by the school for those students who would be taking a vocational course if it were offered, and in these schools a good industrial-arts education program may have considerable *vocational significance* for these students.

The industrial-arts education teacher has a broad general education background and his training is comparable with that of the teacher in academic areas. He must be versatile in his ability to handle tools, machines, and materials. He is more than a mere *handy man* with tools. It is not essential that he be a skilled tradesman in any one trade although actual trade or industrial experience is always desirable. He is, however, a craftsman in using tools and materials. He likes to work with boys and girls and shares with them the enthusiasm of youth as they work individually and co-operatively in the industrial-arts shop. He takes these pupils as they are — the average, below average, and the so-called *bright pupils* and directs their experiences as they work on problems of interest to each individual and to each group.

Industrial-arts education is usually offered in a one room general shop laid out and arranged for a variety of work, although in many schools pupils are routed through a series of specialized shops where

a more intensive experience is provided in separate subjects. Class periods are usually the same in length as the class periods for all other regular school subjects. Classes vary in size from about 15 to 35 or even 40, although 25 is usually considered the limit for best instruction. In many communities the shop facilities are used by adult groups during the evening and on Saturday.

In industrial-vocational education the work is established and organized on a *trade basis* for the sole purpose of preparing the student for entrance into a trade. The emphasis in this kind of program is on skill and production, and many opportunities are provided for skilled workers to acquire additional skill in handling new materials or in mastering new processes in their trade or craft.

Specialized shops are provided for intensive work in such subjects as auto mechanics, machine shop, patternmaking, sheet metal, drafting, printing, etc. The equipment should be representative of that found in industry. Production methods should be used extensively and students should be familiar with production standards as they are found in industry.

Since schools cannot always afford to establish shops for a wide range of highly specialized subjects the facilities of industry are often made available in order to provide a more complete program of vocational education. The school of course can seldom if ever provide complete training for any trade which means that there is a job for the school and a job for industry in establishing trade training for industry.

In other words the school and industry working co-operatively can develop a more effective training program than either could possibly provide alone. The industrial co-ordinator, who serves as the liaison official between the school and industry, is the *key individual* in a good vocational program.

If the program is established on a reimbursable basis then state plans provide the pattern to be followed in organizing the various courses.

The teacher should be skilled in the trade he is teaching which of course requires actual industrial experience. Professional preparation is certainly desirable and is usually required for much of the work.

Classes are usually three hours in length and range from 12 to 18 in size. The student must be 16 years of age before he can enter a program of this kind. The trade extension type of program has been established for adults who are seeking additional training in the trade in which they are engaged.

This brief résumé of a few important characteristics of industrial-arts education and industrial-vocational education will reveal in some respects the difference between the two types of industrial education and at the same time provide for those who are interested, some insight into the various ways in which they are alike. They are beyond a doubt *twins, although not identical*. I have been both disturbed and confused by the development at various times of a feeling of professional animosity between teachers of these two types of industrial education.

They have so much in common although they are of course different. In some cases both types of industrial education classes are taught in the same room by the same teacher. Students enrolled in the two kinds of programs may in some cases even meet at the same time.

A good cook prepares pies, cakes, salads, desserts, etc., in the same kitchen and she doesn't seem to have too much trouble. There seems to be no friction between teachers of French, Spanish, German, etc., in the language arts. Teachers of algebra and geometry seem to work and co-operate very nicely.

On what basis can anyone justify any friction between teachers in the two closely related fields of work which constitute industrial education? A good industrial-arts program is usually considered es-

A student in the machine shop at the Milwaukee Vocational and Adult Schools, Milwaukee, Wis.

— Photograph submitted by Stanley O. Opsahl, instructor of photography

sential to the development of certain types of industrial-education programs.

Teachers of industrial arts often seem to think that they do not need to know anything about vocational education, and teachers of industrial-vocational education often think that it is beneath their dignity to know anything about industrial-arts education.

Is this division in our ranks, which some try to ignore, the result of poor teacher training, ignorance, a lack of professional respect or attitude, a lack of understanding, conflicts in leadership, professional confusion, growing pains, inflated professional ego, professional jealousy, or merely stupidity?

Regardless of the cause it is entirely unnecessary and cannot in any way be justified. We all have too much in common to ever waste energy *pulling in opposite directions*. There are at least 40,000 teachers of some form of industrial education in the United States. If they could work co-operatively and effectively together, achievements and goals could easily be attained that we dare not even dream about at the present time, important as they may actually be.

The two divisions of this important area are both supplementary and complementary to each other. The word *arts* in the term industrial-*arts* education and the word *vocational* in the term industrial-*vocational* education provide the key to the difference between the two. Please note, however, that we have remaining in each term the words *industrial* and *education*.

Those individuals in each group who continue to ridicule and ignore the other group are guilty of *professional treason*. Such actions are so unnecessary, and reveal in many respects the narrow-mindedness of those making accusations.

What have we to lose by putting forth a co-operative effort? Nothing. What have we to gain? A much stronger professional status, which would lead to the development of a stronger and more effective program for each of the two kinds of industrial education.

The Psychological Effects of Color Dynamics

M. CHARLES HANSEN
Chicago, Ill.

Color, with its different shades of brightness and dullness, affects workers' efficiency and morale adversely or complimentarily depending on its use. This generally accepted concept applies to school shops as well as to industrial plants and other places where color is used. Fatigue, eyestrain, and hazards can be minimized by its proper use. Color also improves visibility; provides a pleasant, restful surrounding; and identifies all fire equipment, hazards, and safety equipment in the shops. By improper use of color, the effect can be reversed bringing adverse effects to bear on the workers in the shops.

For these reasons it is particularly important for school shop planners or remodelers to know *how* and *where* color should be used to produce the most desirable conditions, and exert an agreeable influence on students and others who will use or visit the school shops.

To achieve this effect, the dark one-tone gray machines should be repainted. For the best results of the machines and other equipment necessary in the shops colors should have a reflectance value of from 25 to 40 per cent. Contrasting colors within these reflectance values are the most suitable.

Since four shades of gray have become the standard for machines, the application of other colors to critical parts of machinery is most desirable. Cream, light tan, or light contrasting colors are the most desirable for this. Orange, because of its brightness, serves to focus special attention to particularly hazardous parts of machinery. Open guards, special hazards, and electric equipment may well be painted in this color.

In the colors to be used in the shop, the floors, walls, and ceilings should not be neglected. For, despite the fact that machines are colored properly for safety and efficiency, if the walls are left drab and improperly painted, the total effect will be eyestrain and a feeling of depression.

Ceiling paint should have reflectance values of between 80 and 88 per cent, and be unattractive to the workers. Flat paint is the most desirable for this. White has a high reflectance value, and will not cause adverse effects on the workers as they seldom look toward the ceiling.

Floors should be painted with a paint having reflectance values of at least 20 per cent. Desks and other equipment vary in reflectance values from 25 to 40 per cent.

High walls may be white at the top, or may be cream or ivory. But the lower parts of the wall should have a color which has a reflectance value of between 50 and 60 per cent so that the worker's eyes will not have to continually adapt themselves when looking from their work to the walls. Walls within the normal range of vision of the students should have a brightness which does not exceed the brightness of the work areas. Low walls should be one over-all color. Light gray, pale green, or light blue are suitable colors for the portion of the walls which are on eye level with the students, or within the normal range of their vision.

In large rooms, if two colors are desired for the walls — end walls may be one color while side walls may be another color. The best colors for this arrangement are soft tints that do not require the adjustment of the eyes by causing constriction of the

eye pupils. Such tints will relax the eyes.

When picking the colors to be used in the shops, remembering the psychological effects each group of colors has will make the choices easier.

Yellow tints have a cheering, stimulating effect.

Blue has a cooling effect, and is used most effectively where temperature is higher than normal.

Green has the effects of both blue and yellow and is restful to the eyes.

Orange — tints only. Has the effect of warmth. It is too brilliant to use except in tints.

Red brings the feeling of danger and excites the person looking at it.

Violet and *purple* have the effect of richness and luxury.

The pros and cons of using color in the school shops have been discussed for some time. It is generally conceded that the application of proper color combinations to machinery has merit as a means of reducing accidents. Besides this there are the psychological factors which justify, and should encourage, the use of color *throughout* the shops. Dull, drab colors are conducive of dirt and disorder; and, conversely, freshly painted machines, walls, floors in agreeable tones, create and promote an interest in and a desire for maintaining clean and orderly shops. A clean shop is important not only for appearance' sake, but also in helping the prevention of accidents. These good effects may fade if the colors are forgotten once they are applied. If color is applied, every effort must be made to maintain its fresh, clean appearance, for negligence of a painting job well done—allowing the colors to fade — makes the original application of color practically valueless. As machinery must be inspected regularly to keep it in the best possible condition, so colors must be freshened periodically or they will cease to be effective.

A regular inspection of the shops, machinery, and painted ceilings, walls, floors, and equipment, will insure the over-all shop of being kept as efficient as possible. This will keep the right psychological effects in play, and will keep the students at the peak of efficiency and morale while working in the school shops.

REFERENCES

Color in Industry, Data Sheet D-Gen. 44, *National Safety News,* February, 1951. National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Color Dynamics and Safety, E. G. Bruckman, *Safety Education,* March, 1949. National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

What's Your Professional I.Q.?

BENJAMIN J. NOVAK
Murrell Dobbins Vocational-Technical School
Philadelphia, Pa.
Lecturer in Vocational Education
Temple University

All of us in vocational education have been confused, much too often, because the matter with which we thought we were dealing was not defined or understood as being the same thing by all persons concerned.

It is important for everybody periodically to inspect the tools of his trade in order to be certain that all are accessible and in good working condition. So it is with the vocational educators, who must know and agree upon terminology if there is to be understanding and clarity rather than a Babel. Hence, here is brief stock taking of our professional tools in vocational education.

In arriving at the definitions which follow, assistance was derived from too many bulletins, texts, and individuals over a period of time to permit adequate acknowledgment or even accurate identification. Most have been given the personal flavor of the writer. If you don't like the definitions given, try to improve upon them. The objective is a good working set of rules on which most of us eventually can agree.

How many of the following terms can you define before turning to the definitions for help?

1. Vocational Education
2. Vocational Guidance
3. Prevocational Education
4. Manual Training
5. Manual Arts
6. Industrial Arts
7. Practical Arts
8. Mechanic Arts
9. Trade and Industrial Education
10. Industrial Courses
11. Unit Trade Instruction
12. Diversified Occupations ("D.O.") (Cooperative) Program
13. Apprenticeship
14. Vocational Home-Economics Education
15. Agricultural Vocational Education
16. Business (Commercial) Education
17. Distributive Education ("D.E.")
18. Vocational-Technical Instruction
19. Trade Extension Training
20. Related Instruction
21. Which of the above are eligible in some way for federal subsidy under the provisions of the Smith-Hughes, George-Deen, or George-Barden Acts?

Answers to Questions on What's Your Professional "I.Q."?

1. Vocational Education:

Take your pick of three. I prefer "b" for most purposes.

a) (Broad definition) Any instruction that prepares for entry into an occupation.

b) (Moderate) Instruction below college grade (public and private) that aims at preparation for employment.

c) (Narrow) Federally aided public education less than college grade that fits normal persons over 14 years of age for: (1) agriculture, (2) trades and industry, (3) distributive occupations, or (4) home economics.

2. Vocational Guidance:

The process of assisting the individual to choose, prepare for, enter upon, and progress in an occupation.

3. Prevocational Education:

Exploratory occupational education that precedes specific vocational instruction.

4. Manual Training:

(An old broad term) Hand training based upon fundamental industrial processes.

5. Manual Arts:

Woodworking and other hand crafts taught as general education* for developing manual skill and appreciation of good design.

6. Industrial Arts:

A part of general education in which learners experience, understand, and appreciate the materials, tools, processes, products, and conditions of modern industry.

7. Practical Arts:

(A broad term) Includes those phases of general education devoted to manual (or industrial) arts, and the homemaking, agricultural, and business arts.

8. Mechanic Arts:

a) Practical arts instruction applied to both industrial, and assembling and building trades.

b) Refers also to a technical curriculum in secondary school that is preparatory to entry into engineering college.

9. Trade and Industrial Education:

A form of vocational education providing instruction to fit for entry into trades, crafts, and manufacturing pursuits. Work is on a skilled or semiskilled level, and includes occupations for girls and women.

10. Industrial Courses:

Shop instruction intended to develop proficiency in a trade, but *not* operating under federal subsidy for vocational education. Found in some general high schools (notably in Philadelphia).

11. Unit Trade Instruction:

Instruction for persons in full time school attendance that fits for one particular trade or occupation.

12. Diversified Occupations ("D.O.") (Cooperative) Program:

Instructional program in which youth 16 years of age and over obtain systematic occupational training while legally employed in an industrial or business establishment, supplemented by classroom instruction in school.

13. Apprenticeship:

A written or implied agreement between employer and employee in which the latter (apprentice) will receive instruction over a period of years in a craft or trade. (Includes a minimum of 144 clock hours of classroom instruction annually and other requirements.)

14. Vocational Home-Economics Education:

Preparation for the responsibilities and activities involved in homemaking and in achieving family well-being.

15. Agricultural Vocational Education:

Preparation for prospective employment in agriculture, or instruction to increase the proficiency of those already engaged in farming.

16. Business (Commercial) Education:

a) (Broad definition) Education which prepares persons for entry upon, or more efficient service in, a business career. (According to this, distributive education would be one phase of business education.)

b) (Narrower definition) Education which prepares for entry upon, or more efficient service in, office occupations: i.e., secretarial, stenography, bookkeeping, typing, and clerical. (Excludes retailing, therefore omits distributive education.)

17. Distributive Education ("D.E."):

Preparation of persons for entry into or improved efficiency in the business of distributing the products of farm and industry by retailers, jobbers, wholesalers, and others — and that of selling services. (Does not include clerical occupations such as stenography, bookkeeping, office clerical work, and the like.)

18. Vocational-Technical Instruction:

Instruction above high school level, but below college grade, providing specialized training for workers in technical and supervisory positions that are intermediate between manual pursuits and the professions.

19. Trade Extension Training:

Part-time school instruction for apprentices and older employed workers who wish to improve their trade skills or knowledge.

20. Related Instruction:

Instruction that is directed mainly toward enabling students to understand more clearly the shop processes. Related subjects are usually considered to be mathematics, science, drawing, and art.

21. The following in the above list are eligible in some way for subsidy under the provisions of the Smith-Hughes, George-Deen, or George-Barden Acts: 1, 2, 9, 11, 12, 13, 14, 15, 16a, 17, 18, 19, 20.

What is your score?

*By general education is meant curricula that are not primarily and specifically vocational in aim.

An exhibit of work done in the Chicago schools. Robert E. Jelinek, at left, supervisor of electric shops, with Hobart H. Sommers, assistant superintendent in charge of vocational education

— Submitted by Hobart H. Sommers

TOOL STORAGE LOCKER

A. A. SINISI
Edison Vocational and Technical High School
Mount Vernon, N. Y.

Constructed as an improvement over the standard tool panel, the unit shown in Figure 1 incorporates several interesting features.

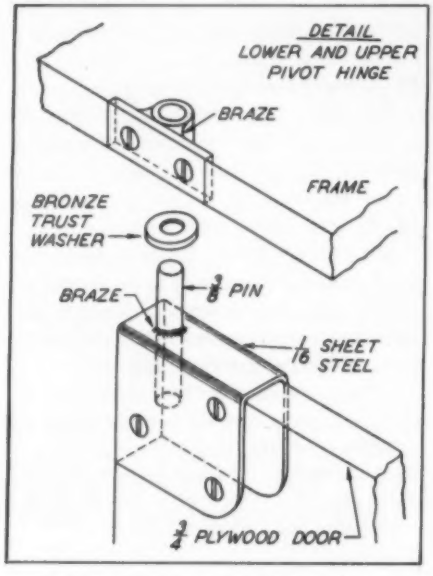


Fig. 2. Pivot hinge

Fig. 3. The tool panel cabinet in the open position. Tools are mounted on the six reversible doors and the five lower doors

Fig. 4. The tool panel shown in the closed, locked position. The lock consists of a bar placed in front of all the doors with a padlock at each end

The uppermost section consists of five lockers for keeping grinding wheels in racks, storing precision instruments and gauges, and other infrequently used equipment.

The next section contains the six reversible doors pivoted on special hinges shown in Figure 2. When all the doors are closed (tools unexposed) the extra door on the left covers a boxlike section containing oil cans, grease gun, and miscellaneous maintenance equipment.

Behind the doors are two shelves and a wall space sufficient for mounting milling cutters and mills, tool holders, and other tools.

Below the doors, five drawers provide a convenient place for keeping drills, taps, reamers, dies, small files, and other small or special tools.

The lowest section which is recessed for toe room, is made up of five lockers with doors, in which hammers, files, saws, and lathe dogs, may be stored. See Figure 1.

The space behind the doors about 6 inches in depth is utilized for miscellaneous tools, equipment, special steels, welding rods, and other materials.

The frame of the structure is made of 1-in. lumber. All the doors are made of ¾-in. plywood.

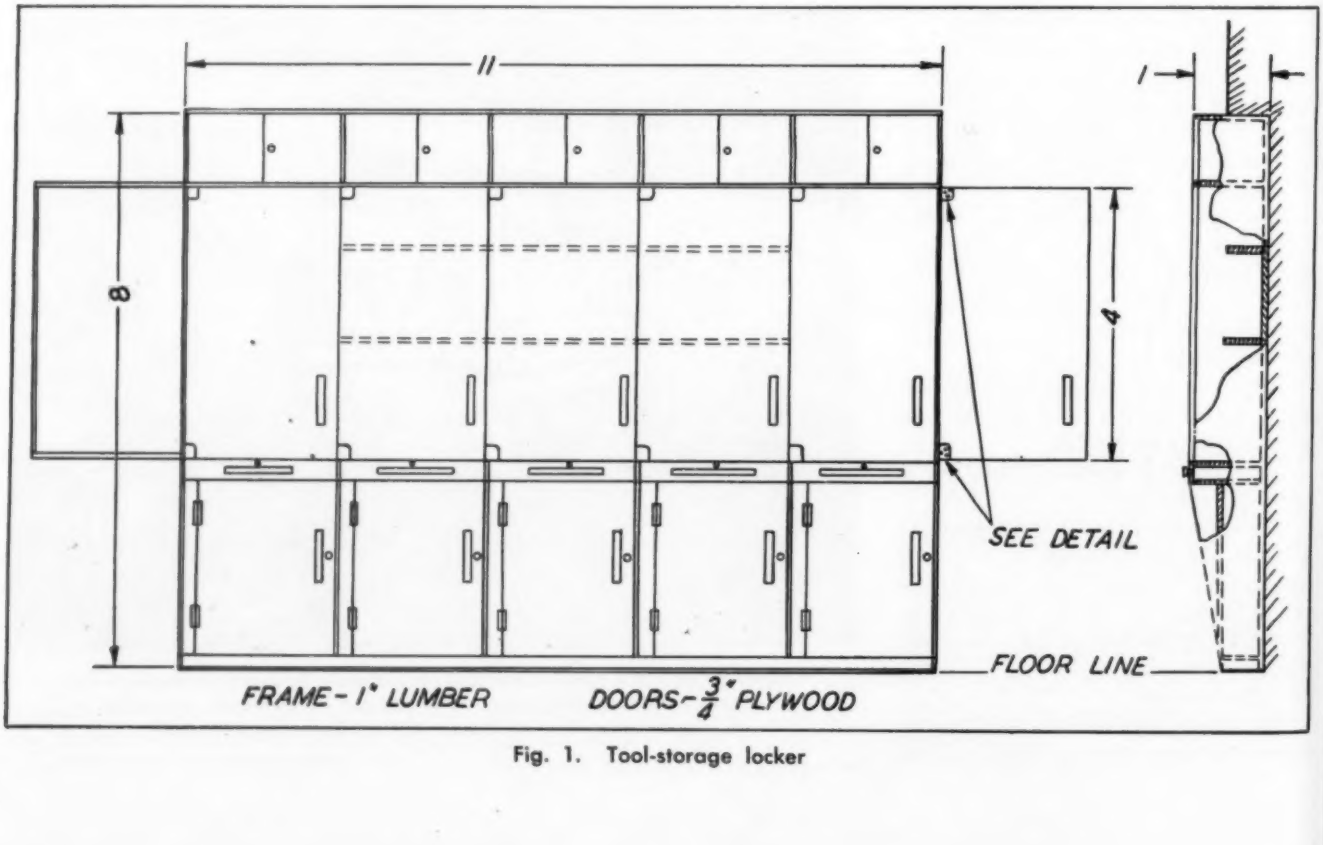


Fig. 1. Tool-storage locker

Fig. 5. A closeup of two of the reversible doors showing the specially designed pivot hinges

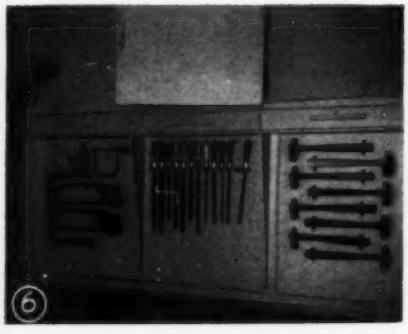


Fig. 6. This shows the construction and appearance of the lower portion of the cabinet. A depth of 6 in. behind the doors is for storage of additional tools and materials and serves as a locker to store tools during the summer

Painted with a soft shade of green semi-gloss enamel, it is easily cleaned, and does not show annoying glare.

INFORMATION SHEET— DESIGNING A PROJECT

WALLACE FILLINGHAM
Industrial-Arts Instructor
Campus School
Western Michigan College of Education
Kalamazoo, Mich.

After choosing the project you are going to make, the next step is to design it. This is a very important step. Regardless of how well a job is made, you will not be proud of it and no one else will like it if it is poorly designed. Design makes a project pleasing to the eye and allows it to fit into the surroundings in which it is placed.

If you find it difficult to sketch an original design of your own, you can usually obtain good ideas from some of the reference books in your shop, or from magazines, catalogs, and even in store windows downtown. Even though you do find a design already drawn to fit your project, probably you will need to make a few changes so that it will fit your needs.

However, whether you make your own original design or copy one already drawn, there are a few very important rules which you must always follow.

1. *Your design must fit the material with which you are working.* You can easily understand this when you think how silly a big heavy project would look with a delicately designed lace table cloth. It would be equally silly to use heavy bold design while working with thin material.

2. *Your design must keep your project balanced.* You can visualize how funny your family car would look if someone should put huge tractor tires on the wheels. The same thing is true when designing a lamp base or any other project.

3. *Your project must be designed to fit the surroundings in which it is placed.* A painted table would not fit into a room in which all of the furniture is finished natural, nor would a fine lacy design fit into surroundings having only straight line design.

4. *The design must never hinder the usefulness of the project.* Never allow your design to weaken your project until it cannot be used for the purpose intended.

MULTI-COMPARTMENT STORAGE RACK OR CABINET

E. A. Rerucha
Franklin Park, Ill.

A simple multi-compartment rack, or cabinet if doors are added, may be built by using tin cans for the compartments. Such a cabinet is useful in the shop, basement workshop, or laboratory. The capacity may be made to suit the needs for a particular purpose and the type of construction provides a large number of compartments easily made in a relatively small space. The writer uses such a cabinet in an experimental laboratory for radio tubes and parts such as, resistors, switches, volume controls, rheostats, etc. It will also accommodate small bolts, nuts, screws, and a variety of other items which will fit the capacity of the can used. The writer has a cabinet with 264 compartments in his shop. The over-all dimensions of the cabinet are depth 5⅝ in.; width 33⅝ in.; height 78 in. (This allows for 1/16-in. clearance between rows of cans.) The dimensions of the can used are: diameter 2 11/16 in.; over-all height 4 13/16 in. This is the 12-ounce can used for canned goods.

From Figures 1 and 2, it is evident that only a framework is necessary. If the rack or cabinet is to be fastened to a wall, a back is not necessary. If a back is desired use ¼-in. plywood and allow that much more for the depth or width of the sides so that the plywood back can be set in between the sides. No specific sizes are given on the working drawing for the width and height of the cabinet since these will depend upon the number of compartments desired. Also, the shape of the cabinet will depend upon the space it is to occupy.

First determine the size according to your own plan for shape and capacity of the particular cabinet you desire to build. An even number of cans should be used in a row if possible because that will permit the center upright or uprights (if more than one is used for support due to the width of the cabinet) to be placed between two cans without obstructing too much of the openings, and the doors, if used, may be of the same size.

Cut out all the pieces required for the frame according to your plan for a particular cabinet. Then assemble the framework except for the front upright pieces. To prepare the cans cut out the tops of each can with a can opener of the type which leaves the sealing flange on the can. Set cans in a row, as many as will be used in a row in the rack or cabinet, and solder the edges together where they touch on both top and bottom of cans. A jig shown in Figure 4 may be made by nailing two boards to end blocks and the cans placed between. When one row of the cans is soldered together on one end, turn over and solder the edges on the other end of the cans.

If the rack is to be without its own back, fasten to wall before placing cans in place. This may be done by using angle brackets screwed to sides and wall on the inside of the framework. A strip 1 by 2 in. is nailed to the wall under the cabinet to help support it. This strip should extend over the sides as they carry the weight. Now insert the rows of cans in place between the horizontal strips. Tack every third or fourth can to the strips near the open end with a No. 16 by ½ flathead nail. A hole is first punched in the can with a sharpened nail or awl. The nail may be forced in with a pair of large pliers or driven in with a hammer. If driven in with a hammer a shock block should be held under the nail when doing so. When cans are all in place nail on the vertical strip. A single No. 4 finishing nail through the vertical to horizontal pieces will be sufficient. Again, use a shock block in back of each nail when nailing.

For a rack or cabinet of considerable width it is evident that additional support must be given the horizontal pieces supporting the rows of cans. In the front more vertical strips must

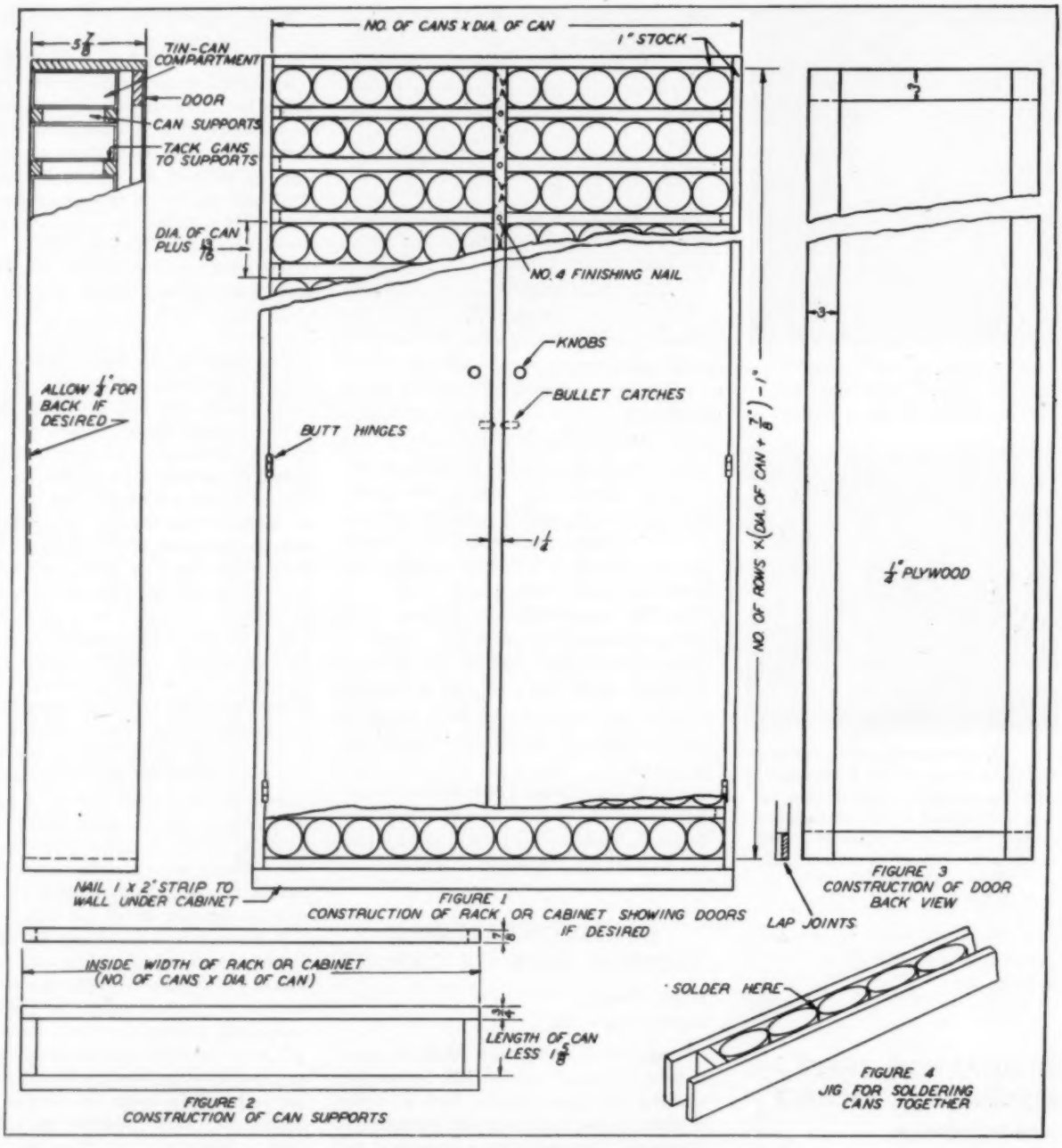

NO. OF CANS X DIA. OF CAN
1" STOCK
TIN-CAN COMPARTMENT
DOOR
CAN SUPPORTS
TACK CANS TO SUPPORTS
DIA. OF CAN PLUS
NO. 4 FINISHING NAIL
KNOBS
BULLET CATCHES
BUTT HINGES
ALLOW FOR BACK IF DESIRED
NO. OF ROWS X (DIA. OF CAN +) - 1"
PLYWOOD
NAIL 1 X 2" STRIP TO WALL UNDER CABINET
LAP JOINTS
INSIDE WIDTH OF RACK OR CABINET (NO. OF CANS X DIA. OF CAN)
LENGTH OF CAN LESS
SOLDER HERE

FIGURE 1
CONSTRUCTION OF RACK OR CABINET SHOWING DOORS IF DESIRED

FIGURE 2
CONSTRUCTION OF CAN SUPPORTS

FIGURE 3
CONSTRUCTION OF DOOR BACK VIEW

FIGURE 4
JIG FOR SOLDERING CANS TOGETHER

Multi-compartment rack or cabinet

be used and also in the back, to which the back horizontal strips are nailed as already described. For wide cabinets it may be desirable to use a plywood back. This of course means that the depth of the cabinet or width of sides must be increased to allow for this.

If doors are desired they may be constructed from ¼-in. plywood as shown in drawing, Figure 3. Bullet catches only are shown on the drawing. However a lock or padlock hasp may be provided as desired.

Note that the horizontal strips under each row of cans are wide enough so that labels may be placed under each can to identify the contents or sizes.

No list of materials is provided since this will vary with the shape and capacity of the cabinet which the reader may desire to build. This article is merely a suggestion as to how a cabinet may be constructed which is economical and flexible as to shape and capacity.

Every month last year there were 131,000 patients and domiciliary members in VA hospitals and homes. To serve these veterans, a monthly average of 22,100 Red Cross volunteers gave a total of 2,186,300 hours of service. — *American National Red Cross.*

Last year, 299,500 pedestrians were injured in the United States.

Ninety-eight per cent of drivers involved in fatal automobile accidents in the U. S. last year had at least one year's driving experience.

MASONITE TOOL BOARD AND BENCH TOP

MASONITE CORPORATION
Chicago, Ill.

On a piece of heavy wrapping paper, lay out your tools, grouping them in a rectangle. Bear in mind how these tools must be easily reached when in a vertical position.

First construct a framework of ¾ by 1½-in. fir or yellow pine as shown in Figure 1, using intermediate supports of the same size spaced approximately 16 in. o.c. These may be all fastened together with corrugated fasteners. This framework should be then attached to the back or screen side of a piece of ¼-in. Masonite Tempered Presdwood. The Tempered Presdwood should be nailed from the face side to the intermediate supports first, starting with the center support and then nailing the edges.

The nails should be *2d* casing head cement coated, and should be spaced approximately 6 in. apart through the body of the board on the intermediate supports and not to exceed 3 in. apart around the edges.

Nail on the top flat rail to the top framing piece and the ¾ by 1½-in. wood tray shelf to the bottom framing piece. Shape the side stile, also the ¾ by 1½-in. wood top and bottom, and fasten to the wall, and mortise to receive top rail. Nail to side framing pieces. Make tray-shelf edges and fasten to side stiles. Screw through side stiles to back framework and to shelf ends.

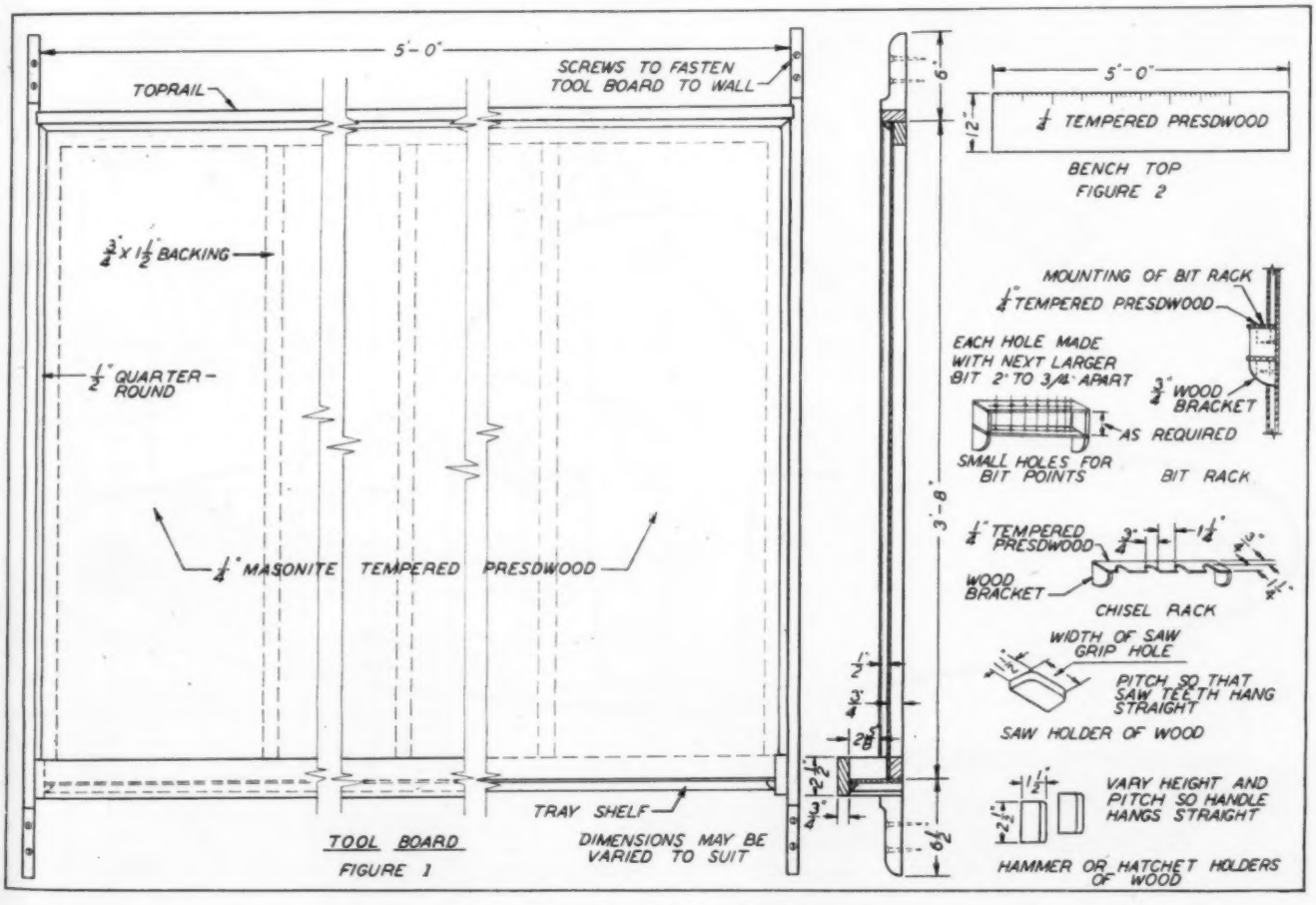
Apply ½-in. quarter round molding to side and top edges and to underside of tray shelf. Countersink all nail heads in wood framing and cover with plastic wood. Nail heads in Tempered Presdwood should be driven flush with the surface.

Lay the tools on the board in the same position as was worked out on the wrapping paper. Mark out their position in pencil. Now make the racks, holders, and hangers of wood or ¼-in. Masonite Presdwood using the patterns suggested by the drawing, working out others to suit your particular tools. Thread spools will also make excellent holders and are held to the board with carriage bolts.

After the racks are cut out they should be mounted on wood brackets as shown and attached in position to the ¼-in. Tempered Presdwood backing with screws through the Tempered Presdwood into the wood brackets. Holes should be drilled through the Tempered Presdwood of proper size and in proper location for these screws.

Trace the silhouettes of your tools on heavy wrapping tissue or tracing paper and cut out. Using a clean paint brush apply a thin film of water to one side of the pattern, and then cover with a thin coat of glue. In applying the patterns to the board start at one end and follow the tool outline, smoothing out the air bubbles. Allow to dry thoroughly.

Sand down the wood surfaces. Apply a very thin coat of shellac over the Masonite and wood and paper patterns. When dry rub down with steel wool. Apply an additional thin coat and again rub down. Bore



Masonite tool board and bench top

two holes through the shaped tops and bottom of the stiles and hang the tool board in the most convenient position in relation to the bench.

NIGHT-SIGNAL WRIST STRAP

JOHN S. LORR
Cupertino, Calif.

It is common knowledge that in night driving hand signals are difficult to see, which unfortunately is the cause of many accidents.

A solution is the use of a dark leather wrist strap to which a cutout arrow of *Scotch Lite* material has been cemented. You will find that the headlights of any car approaching from the rear will clearly pick up this signal.

As a leather project the wrist band is very simple to make. First, ascertain, by means of a piece of paper, your wrist size. Translate this into the length of the strap, using it as a measure between the parts of the snap. Make your pattern out of paper or lightweight cardboard, trace it on dark leather, and cut it. Next, trace the arrow shown in the illustration on the top side of the leather strap and also on the reverse side of the *Scotch Lite*. (This is a beaded material which reflects light, manufactured by the Minnesota Mining Company.) It may be cut readily with scissors.

Paint the inside of the arrow traced on the leather strap with clear lacquer and press the cutout *Scotch Lite* arrow against this lacquered surface before it dries. All that remains is to attach a snap to the strap by means of a snap setter. A small buckle may be used as a fastening device if preferred, in which case the ends should be treated like a wrist watch strap.

The night-signal wrist band does not interfere with your driving and, during the daytime, it can be kept in the glove compartment.

BIG BUSINESS MUST HELP VOCATIONAL EDUCATION

OAKLEY FURNEY
Menands, N. Y.

Collier's Weekly for June 2, 1951, has a forceful article on "Big Business Must Help Our Colleges."

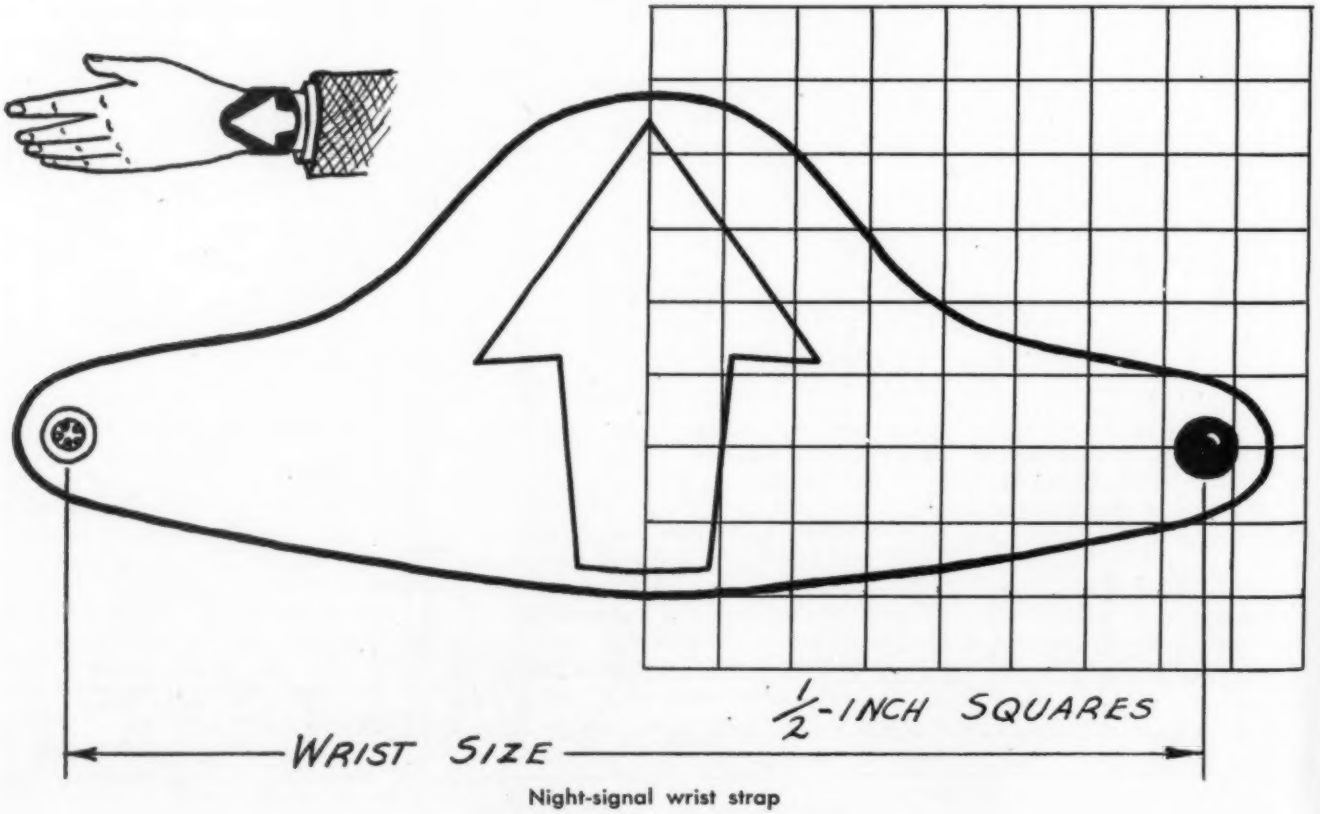
The National Association of Manufacturers recently issued an important bulletin, entitled "Working Together," which presents descriptions of the kinds of vocational education which employers should support.

It is very clear that both public and private vocational schools are entitled to the help of Big Business as well as our colleges. The vocational schools, like the Samuel Gompers Vocational High School of New York City, and the Burgard Vocational High School of Buffalo, train teen agers and adults for useful employment in trade, industries, agriculture, commerce, and homemaking. Only high school graduates may enter college, but the vocational schools admit those who can profit by the instruction from 14 to 60 years of age. The number of persons needing vocational education is from 40 to 60 per cent of the total population. Perhaps 10 to 20 per cent of all our high school graduates enter college, and not more than 50 per cent of this group actually graduate from college.

Our skilled workers — farmers, carpenters, machinists, printers, clerks, stenographers, sales persons, and homemakers are the most important segment of our population. They do the work which provides the basis for all our culture. The better prepared for their vocations they are, the greater will be our national production. We must produce more and more if we are to survive.

Big Business should support apprentice training, occupational extension training for employed workers, agricultural education in our secondary schools, technical and trade education in our high schools, distributive education for store workers, secondary school commercial education, mining schools of secondary grade, arts and crafts training for our rural population, work and study programs for needy high school students, and home-

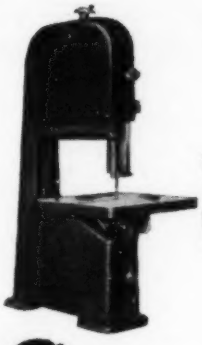
(Continued on page 70A)



Night-signal wrist strap

SHOPMASTER TOOLS

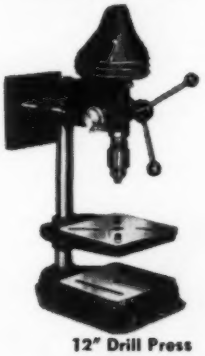
MEET DEMANDS OF ANY SCHOOL



12" Band Saw **$87.50***
10" Band Saw **$46.45***

Saber Saw **$17.95***

10" Wood Turning Lathe **$45.95***



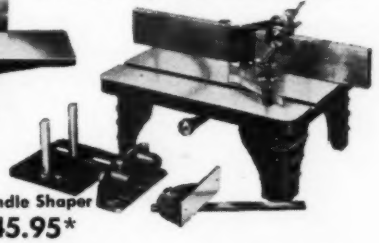
12" Drill Press **$47.95***
12" Floor Model Drill Press **$54.00***

7" Tilting Arbor Bench Saw **$47.95***

8" Tilting Arbor Bench Saw **$76.95***

8" Tilting Table Bench Saw **$51.50***

6" Jointer **$79.95***
4" Jointer **$47.95***



Spindle Shaper **$45.95***

Belt and Disc Sander **$51.50***

15" Jig Saw **$27.95***

10" Floor Model Tilting Arbor Saw **$105.00***

*Zone 2, less motor. Slightly lower, zone 1.

SHOPMASTER

woodworking tools Give Top Performance

The two requirements any school demands of tools are performance and durability. Shopmaster Tools have met this test in schools from coast to coast.

Operated day after day by beginners and students of varying degrees of proficiency, these tools stand up and give amazing results. And they do it for years without an indication of the grueling daily strain to which they're put.

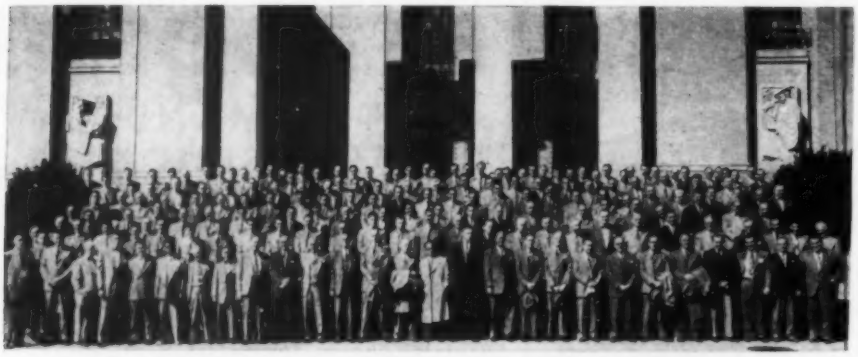
These are precision-built tools with handsome modern lines, designed for convenience. They can be independently powered, or mounted together and powered with one motor.

No doubt about it, the toughest league in the world for a tool is a school. And Shopmaster Tools meet any school's most rigid requirements 100 per cent.

SHOPMASTER TOOLS

SHOPMASTER, INC.
1214 Third St. S., Minneapolis, Minn.

Send me your new full color catalog giving full details on the complete line of SHOPMASTER "Uniform Precision" Tools, and shop layout sheet.



Annual Industrial Education Conference held at the Pennsylvania State College on October 13, 1951

— Photograph submitted by S. Lewis Land, head, department of industrial education

SHELDON

CHICAGO U. S. A.

Important ★

above all else in school lathes

★ **SHELDON SAFETY**

. . . all belts, pulleys, countershafts, gears and motors are completely enclosed. Speed changes and gear-ratio changes are made by external shift levers.

★ **SHELDON PRECISION**

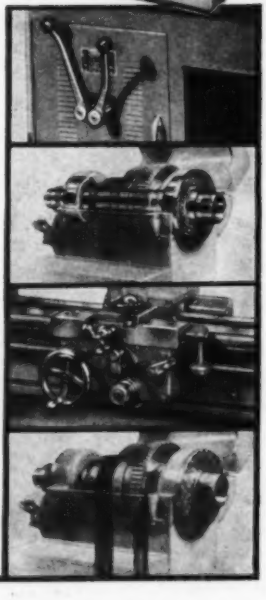
. . . Timken "Zero-Precision" Tapered Roller Spindle Bearings (the absolute in accuracy) permit student work to ten-thousandths of an inch, and hold this accuracy without constant maintenance.

★ **SHELDON CONTROLS**

SHELDON-taught students are ready to operate standard industrial lathes—are familiar with standard controls and the "big lathe feel".

★ **SHELDON CAPACITY**

The extra swing and greater collet capacity increase the range of possible student projects—from the "playing store" group to the practical. The extra power to the spindle, the speed range, weight and strength of SHELDON Precision Lathes permit heavy cuts, spinning and demonstration of correct use of new cast-alloy and carbide-tipped cutters.



Built by modern methods, with the finest machine-tool special machinery, on a continuous production line basis, these better lathes cost little more than ordinary school type lathes. *Write for Catalog*

SHELDON MACHINE CO., INC.

4244 North Knox Ave., Chicago 41, Illinois

Personal News

♦ Dr. Claude W. Fawcett, formerly superintendent of schools in East Grand Rapids, Mich.; Henry W. Calvert, formerly associate professor of economics, Westminister College, New Wilmington, Pa.; Charles N. Hill, a former instructor at Michigan State College, East Lansing, Mich.; and G. Wesley Ketcham, formerly Connecticut state supervisor of industrial arts, were named division educational directors for the National Association of Manufacturers, each for a given geographic region, and will have the twofold task of encouraging closer industry-education co-operation and understanding, and of stimulating stronger industry support of education.

Dr. Fawcett will be responsible for the association's education activities in eleven western states, and will have his offices in the Russ Building, San Francisco, Calif.

Mr. Calvert, whose region covers 12 southern states, will have his office in Atlanta.

Mr. Hill, educational director for Michigan, Ohio, Pennsylvania, West Virginia, Delaware, and Maryland, will have his headquarters in Detroit.

Mr. Ketcham, whose region consists of New York, New Jersey, and the six New England states, will have his office in New York.

♦ Dr. Louis V. Newkirk will teach two graduate courses at Cornell University, Ithaca, N. Y., during the summer session, July 7 to August 16, 1952. He will conduct a graduate seminar on industrial-arts education and teach a course on the supervision of industrial education.

♦ Dr. Floyd L. Miller, director of the research division of the Standard Oil Development Company, has been appointed vice-chairman of the Research and Development Board, Department of Defense.

♦ Matthew L. McHugh, chief of vocational rehabilitation and education at the Veterans Administration Fort Jackson Regional Office at Columbia, S. C., has been appointed assistant manager of the Columbia V.A. office.

An official of the V.A. and predecessor agencies for thirty years, Mr. McHugh replaces William W. McBride, who recently was promoted to the managership of the regional office.

♦ Dr. Kent R. Van Horn, one of the nation's leading research metallurgists and an authority on industrial X-ray, is the new director of research since January 1, for the Aluminum Company of America.

A veteran of 22 years with ALCOA, Dr. Van Horn will advance from the position of associate research director to succeed Dr. Francis C. Frary, who is retiring.

♦ Alfred Africano has been appointed an adjunct assistant professor in the Aeronautical Engineering Department of New York University's College of Engineering, to teach a new graduate course — "Introduction to Rocket Propulsion" — beginning in February, Dean Thorndike Saville announced recently.

♦ Lee Bushong, who has been teaching industrial arts at the High School, Kendallville, Ind., has been named co-ordinator of the co-operative education program which is being inaugurated in Kendallville this year.

♦ Earl C. Floyd, instructor at the Iowa State Teachers College, Cedar Falls, Iowa, taught classes in industrial arts for the elementary grades in the department of industrial arts at Ball State Teachers College.

(Continued on page 72A)

Capture your audience from the first frame . . .

The new Kodascope *Pageant* Sound Projector

Sound movies are a potent tool for sales, training, and education—a wonderful entertainment medium. The Kodascope Pageant Sound Projector provides the realism in sight and sound that means convincing performances every time with 16mm. movies.

An improved optical system gives unusual projection brilliance. Pictures are sharp and clear from corner to corner. And the Pageant's unique audio system and "sound focusing" control assure clear, authentic tones at all volume levels.

Easy to thread and operate, the Kodascope Pageant, complete with speaker in a single case, weighs only 33 pounds. Rugged construction and permanent lubrication mean years of service. Price—$400. See it at your dealer's, or write for the free booklet, "The Kodascope Pageant Sound Projector." Eastman Kodak Company, Rochester 4, N. Y.

Price subject to change without notice. Consult your Kodak Audio-Visual dealer.

FOR EDUCATION and ENTERTAINMENT

• Ideally suited for classroom or auditorium audio-visual instruction and entertainment • Ease of operation and ability to withstand abuse assure long, reliable life • Brilliant screen image and faultless sound reproduction mean no straining of eyes and ears. Also shows silent films, and has connection for microphone or record player.

MOTION PICTURES . . . teach, train, entertain

EASTMAN KODAK COMPANY, Rochester 4, N. Y. 193

Please send me ☐ your folder "The Kodascope Pageant Sound Projector"; ☐ arrange a showing of your special Kodascope Pageant Sound Projector demonstration film.

NAME_____

STREET_____

CITY_____ ZONE_____

STATE_____

Teachers!

YOU MIGHT BE ON A Prizewinning Team RIGHT NOW!

THERE'S A BIG OPPORTUNITY FOR YOU AND YOUR STUDENTS IN THE 1952 I.A.A. PROGRAM
NATIONWIDE RECOGNITION
MORE THAN 1,000 INDIVIDUAL AWARDS FOR YOUR STUDENTS, WITH CASH PRIZES TOTALLING MORE THAN $45,000
30 EXPENSE-FREE TRIPS TO DETROIT

INDUSTRIAL ARTS AWARDS — FORD MOTOR COMPANY

Hurry . . . there's still time for your students to enter their shop projects in Ford's nationally known Industrial Arts Awards program . . . students in grades 7 through 12 are eligible.

30 exciting trips to Detroit for teachers whose students win Outstanding Achievement Awards. 3 days in the world's automobile capital . . . including a tour of the famous Ford plant at River Rouge.

Ten divisions cover practically any project! Wrought metal . . . pattern-making and molding . . . machine shop . . . wood working . . . electrical . . . plastics . . . mechanical drawing . . . architectural drawing...printing...open.

Project size is not important . . . but *quality* counts! Project need not be special . . . *enter the best ones your students are making right now!*

ENTRIES will be received in Dearborn between May 1 and June 10, 1952. Please write to the address below for full information and entry blanks.

INDUSTRIAL ARTS AWARDS
FORD MOTOR COMPANY

2930 Schaefer Road • Dearborn, Michigan

SCIENTIFIC ANECDOTES FOR THE ELECTRICAL SHOP

ROD HOBSON
Industrial Arts Instructor
Winona State Teachers College
Winona, Minn.

Static Electricity — The Human Spark Plug

Three thousand years ago, Thales of Greece first produced man-made static electricity.

It has been an influence in the life of man ever since. Some of its effects are good, and are produced intentionally. Others are very dangerous, and must be guarded against vigilantly.

Home dry cleaning can be very dangerous. Rubbing of certain materials (such as wool or silk) creates static electricity. This has injured and killed many people who tried dry cleaning at home in a close, unventilated room.

One true story is about a woman who was cleaning a rug with a cloth saturated with gasoline. The fumes exploded when the rubbing generated a static spark. The woman died of burns.

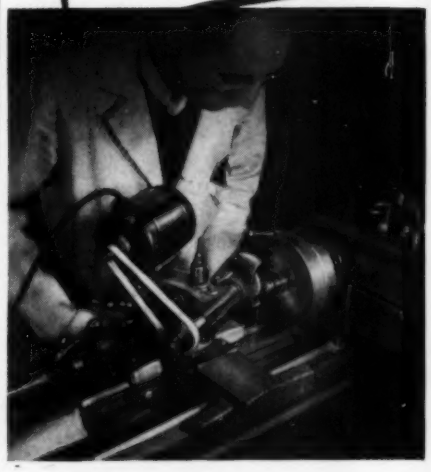
Gasoline evaporates and forms an explosive vapor very easily. The Underwriters' Laboratory scientists have ignited this vapor from a flame 200 feet away! Is it any wonder that a static electric spark in the midst of the vapor can cause an explosion? Or why filling stations post "No Smoking" signs?

Another freak accident happened to a physician answering a night call. He put on rubber boots, and then a fur coat. There was friction on the fur, of course, when he put on the coat. The rubber boots prevented the static charge from leaving his body. He hastened to the garage and reached out to touch the car. A spark from his finger exploded fumes from leaking gasoline and blew him through the door.

You can store up 10,000 volts of static in your body simply by walking across a room on a thick carpet! That's enough to make a one-half-inch spark in dry air.

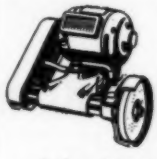
Theoretically, friction between any two different materials will produce static electricity. You can give a strip of newspaper a static charge very easily. Take some strips of paper. Hold them against the wall. Rub one with leather, another with rubber, others with cotton, wool, and silk cloth. The rubbing will cause the paper

TEACH PRECISION GRINDING



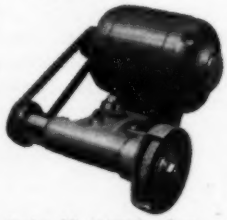
It's EASY... and economical too, with

DUMORE®
Tool Post Grinders

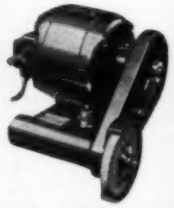


Yes, you can modernize your industrial arts curricula the low-cost, easy way. Students can learn precision cylindrical and surface grinding with portable Dumore Tool Post Grinders mounted on shop lathes. Teach both internal and external operations . . . with accuracy to .0001".

Dumore Tool Post Grinders are industry proved too . . . standard equipment in shops throughout the nation. Students find they are easy to use. You'll like their ability to stand up under student operation.



Series 44, internal and external, ¼ hp. Wheel capacity ⅛" to 3". Maximum grinding depths 3". For lathes with 9" to 13" swing - - - - - $135.00



Utility Model. External. ¼ hp. Wheel capacity 4". For lathes with 9" to 13" swing - - - - $67.50

Your industrial distributor will gladly demonstrate the quality line of Dumore precision Tool Post Grinders. See him today, or write

The DUMORE Company
1300 Seventeenth St.
RACINE • WISCONSIN

either to take electrons from, or add some to, the material. This makes the paper strip have either a positive or negative charge. (Whichever body has the most electrons is negatively charged.) The electrically neutral wall is either more positive or more negative than the charged paper. You know that opposite charges attract, so the wall and the strips of paper attract each other. The paper will cling to the wall until the electric charges are equalized by electrons slowly seeping from the negative body to the positively charged body.

This same kind of static electricity plays many tricks. One day a farmer sprayed his orchard. The wind blew the spray so that his clothes became covered with the inflammable chemical. His clothes dried in the breeze, and as he walked home the static generated by the fabric rubbing between his legs set fire to his pants!

So you see, static electricity is always with us. You never know when you may become a human spark plug!

For additional reading:

Gordon Schendel, "Trouble Trappers, Inc.," *Colliers*, Vol. 122, No. 19 (November 6, 1948), p. 40.

Paul W. Kearney, "Baby Lightning," *Science Yearbook of 1944* (Garden City, New York. Doubleday, Doran and Company, Inc. 1944), pp. 100–104.

Carleton J. Linde, *Science Experiments with Ten-Cent Store Equipment* (Scranton, Pa.: International Textbook Company, 1941).

Static Electricity — Lightning Didn't Strike

Lightning didn't strike, and we in the United States are lucky, for it could have killed Benjamin Franklin that evening in 1752.

Franklin was flying a kite! An odd pastime for a grown man? Perhaps, but he was one of the first real scientists; he was a man not bound by superstition and mystery. Franklin knew the superstitions about lightning. The ancients believed that anyone struck dead by lightning was incorruptible, and was to be held in great honor. None the less, the living preferred life to honor, and believed the eagle, the sea calf, and the laurel to be protectors against being struck by lightning. But Franklin chose to get the *facts* before he let his mind form an opinion about lightning. Here is what he did.

Franklin thought lightning was electricity, but how to be sure posed quite a problem. He finally decided to tie a metal key to the lower end of a wet string, held high

(Continued on page 37A)

WILLSON
dependable
eye protection
keeps you on the safe side
WILLSON SAFETY EQUIPMENT
Combined protection, comfort and appearance make Willson safety spectacles outstanding in value. Choose from a full range of metal and plastic frames—fitted with Super-Tough* heat-treated glass lenses, or Plas-Tough* plastic lenses—every one tested for impact resistance and optical quality. Send for catalog describing our complete line of safety equipment.
STYLE AH
METAL FRAME Latest style spectacle with single bridge. Have Hi-Line temples with a "dressy" look. Also available with side shields. (Non-flammable plastic frame Style WKS shown at top.)
CHOOSE YOUR FAVORITE LENSES FOR ANY WILLSON SPECTACLES
SUPER-TOUGH*
WILLSONITE®
PLAS-TOUGH*
Three popular types of lenses are available for all Willson Spectacles. Clear glass Super-Tough*, Willsonite® Green Super-Tough* and the new Plas-Tough* lenses that combine the impact resistance of heat-treated glass with the comfort of lightweight plastic.
*Trademark

See your WILLSON distributor or write for Catalog

WILLSON PRODUCTS, Inc., 216 Washington St., Reading, Pennsylvania

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — Teachers', and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking — Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, ⅛ pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/16 in. and 5/16 in.
- b) Cold, 5/16 in. and ¾ in.
- c) Diamond point, 3/16 in. and ½ in.
- d) Roundnose, 3/16 in. and ½ in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes.

COMBINATION SQUARES — with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to ½ in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, ½ in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.
- b) Blades, power, 14T, 12 in.

(Continued on page 32A)

specify tools with a knack for students

16" Royal bench drill. Also available: floor model. Both with single or multiple spindles. Catalog D-100.

18" Royal floor drill. Also available: bench model. Both with single or multiple spindles. Catalog D-101.

Students with a knack for tools . . . trained on Canedy-Otto Cincinnati drills move smoothly into industrial jobs where the same dependable drills are used. There's no doubt about it — Canedy-Otto Cincinnati economy-priced drills help students do accurate work, encourage craftsmanship, and build respect for fine tools.

These precision *machine tools,* built by *machine tool people,* utilizing *machine tool know-how,* are priced within easy reach of school budgets. Delivery to suit your requirements. Write today for descriptive literature and specifications.

CANEDY-OTTO
CINTILATHE
OF OUTSTANDING VALUE

CINCINNATI 9, OHIO, U.S.A. **cincinnati lathe & tool co.**

'Rugged-Dependable-"Shop-Tested"

A TRULY GREAT POWER SAW

...with more power
greater accuracy
increased capacity
...and safety

This Duro 10" Tilting Arbor Saw is rapidly becoming the foremost power tool in its price class. Streamlined, ruggedly built for toughest classroom use, it is unmatched for quality, performance and productivity. Here's why:

INCREASED CAPACITY and POWER — cast iron table is 32" x 25" with extensions — with full 10¼" ahead of the blade. Maximum distance from blade to fence is 15¾". Saw arbor, equipped with precision ball bearings, tilts to 45°, stops at 90°. You can cut material up to 3¼" in depth. Fence has front and rear locks which adjust at front . . . assuring greater accuracy.

MAXIMUM SAFETY — newly designed rip fence has a new "T" type safety guide bar . . . new blade guard allows operator to see work in safety . . . Lock-type switch prevents accidental operation of saw . . . safety motor mount accepts odd-size and standard motors.

Write for FREE Illustrated Catalog giving full details and more complete specifications on this Duro 10" tilting arbor saw . . . and other Duro precision engineered power tools.

DURO METAL PRODUCTS CO.
2698 N. Kildare Ave. • Chicago 39, Ill.
Also Makers of
Duro-Chrome Hand Tools.

Gentlemen: Please send me full details on your 10" Tilting Arbor Saw . . . plus catalog showing complete line of power tools.

Name.....

Address.....

City.....State.....

THERE'S A DURO POWER TOOL FOR EVERY SHOP TO SATISFY EVERY BUDGET!

Precision-Built Band Saws in 10", 12", 15" and 16" sizes.

Router Shaper Carver — a multi-purpose power tool — 3 tools in one

Drill Presses in 14" and 18" sizes with many built-in quality features.

Versatile Scroll saws in 3 sizes 12", 15" & 26".

Plus a complete line of jointers, sanders, lathes and accessories.

(Continued from page 30A)

c) Frames, adjustable
HAMMERS
a) Babbitt
b) Ball peen, 13 oz., 16 oz., or 20 oz.
c) Blacksmith's, various kinds
d) Riveting, 9 oz., and 12 oz.
e) Setting
INDICATOR
a) Center
b) Universal or universal dial test
c) Speed
KNURLING TOOL — with assorted knurls
LADLES
a) Bull
b) Hand bowls
c) Melting
LATHE DOGS — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.
LEGGINGS — fireproofed duck, to protect students when pouring in foundry
LEVEL — 6-in. bench
LIFTING SCREWS — for molders
MALLETS — wood or soft
MANDRELS — selected sizes
MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.
MOLDING BOARDS
MOLDING STICKS AND TROWELS — various kinds
NIPPERS — end cutting, 5 in.
OIL STORAGE TANK — with pump
OILSTONES — medium and fine
PAILS — galvanized, 12-qt. capacity for foundry
PARALLELS
a) Adjustable
b) Steel, assorted sizes
PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.
PUNCHES
a) Center, ¼ in. and ⅜ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.
RAMMERS — for foundry
a) Hand
b) Floor
REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank
RIDDLES — ¼-in. and ⅛-in. mesh, 18-in. diameter, for foundry
RIVET SETS — assorted sizes
SCALES
a) Steel, 6 in., graduated 1/64 in. to ⅛ in.
b) Steel, 12 in., graduated to 32nds
SCREW DRIVERS — 6 in. and 9 in. blade
SCRIBERS
SHOVELS
a) Coke
b) Sand
SNIPS — tin, 3 in. straight and 3 in. curved
SOCKETS — for taper shanks, drill and tools, selected sizes
SOLDERING COPPERS AND HANDLES — 1-lb. size
SPRAY CAN — for molders
SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry
SPRUE PICKS — for molders
SQUARES
a) Machinist's, 6 in.
b) Blacksmith's
STEEL FIGURES — ⅛ in.
STEEL LETTERS — ⅛ in.
SWABS — for molders
TAPELINE — steel, 25 ft.
TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.
TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry
TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading
TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.
TRAMMEL POINTS
V BLOCKS AND CLAMPS
WHEEL DRESSER
WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

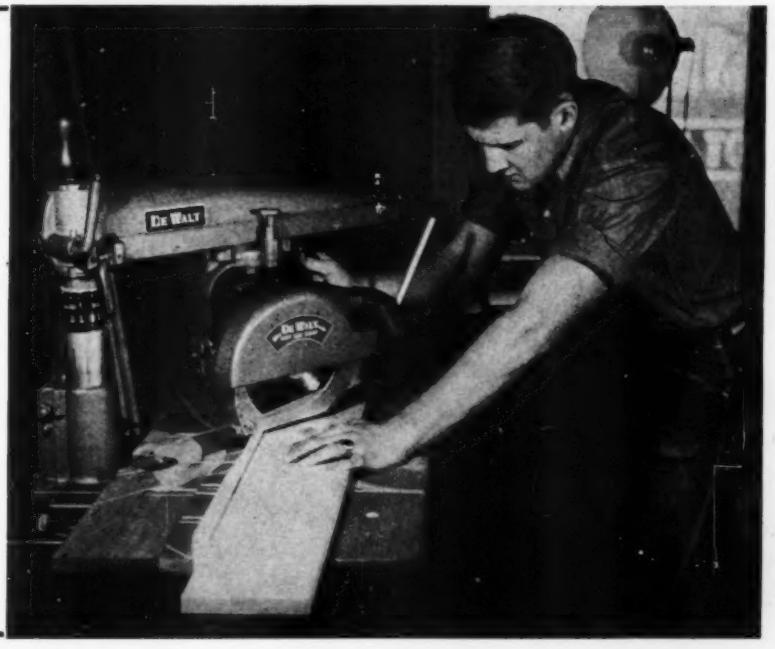
Metalworking — Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide
ABRASIVE WHEELS
ACETYLENE GAS — in drums for welding
ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.
BABBITT METAL
BEARING BLUE
BELT DRESSING
BELT LACING MATERIAL
BELT LEATHER
BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes
BRASS
a) Bars, 3/32 in., ⅛ in., 3/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 34A)

DEWALT

...the ideal all-purpose machine for vocational schools



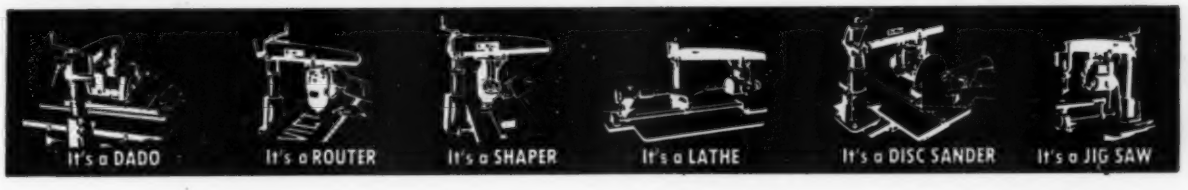
Hundreds of schools today are using DeWalt in their vocational training. This world-famous radial power saw enables students to learn *now* for *tomorrow!*

DeWalt is fast—accurate—safe. It's the basic woodworking machine for doing everything in woodworking. It also cuts plastics and light metals.

This *basic woodworking machine* includes: Pressed Steel Table Frame, Table Top Assembly on Steel Leveling Cleats, Machine Column and Base and Cantilever Arm, Grease Shielded Ball Bearing Carriage with frictionless Swivel Yoke Assembly, Direct Drive Motor with Grease Sealed Ball Bearings, Formex-Fiberglass Insulation, Overload Protective Cut-Out Switch, Special School Safety Saw Guard with Anti-Kickback Device and Set of Wrenches.

DeWalt is compact—takes up little floor space. Investigate the full merits of this all-purpose machine. It is available in models ranging from ½ H.P. to 7½ H.P. Write for complete information. Address: Dept. IA-12, Fountain Avenue, Lancaster, Pa.

DEWALT INC.
A subsidiary of American Machine & Foundry Co.



IF YOU DO METAL SAWING IN YOUR SHOP...

a RACINE "Utility" METAL SAW

...WILL
...SAVE TIME AND METAL
...DO THE JOB FASTER
...DO IT MORE ACCURATELY

One of the handiest machines in any institution or school shop. The "Utility" model is the metal saw so popular in large and small industrial shops used to augment high production, automatic metal saws. It is the perfect saw for general purpose, all around metal cutting work up to 6" x 6" capacity.

Compact — hydraulically operated — fully guarded, a 15-year-old can learn to operate the "Utility" model in 30 minutes. Available in either Wet Cut or Dry Cut styles.

Other RACINE metal saws are available up to 20" x 20" capacity. Write us about your metal cutting work. Address Racine Tool and Machine Co., 1780 State St., Racine, Wisc.

Investigate our Oil Hydraulic Pump and Valve line. Ask for Catalog P-10-D.

RACINE

Standard for Quality and Precision

(Continued from page 32A)

- *d*) Strips, 1/32 in. and 1/16 in. thick, 1/2 in. to 1 1/4 in. wide, 50 ft. to a coil, selected sizes
- *e*) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, 1/4 in., and 5/16 in., in 24 in. lengths, selected sizes
- *f*) Wire, soft, 8, 11, and 14 American gauge, selected sizes
- *g*) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
- *a*) Charcoal for foundry or forge
- *b*) Coke for foundry
- *c*) Forge

COPPER
- *a*) Pigs, for casting alloys
- *b*) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
- *c*) Tubing, outside diameters, 3/16 in., 1/4 in., 5/16 in., 3/8 in., 1/2 in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
- *d*) Wire, soft, 2 to 20 American gauge, in coils. Also in 1/4, 1/2, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
- *a*) Boiled linseed
- *b*) Lubricating
- *c*) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — black asphaltum

PINS
- *a*) Cotter, 3/32-in. to 1/4-in. diam. from 1/2 in. to 2 in. long
- *b*) Flask, for flask repairs
- *c*) Taper, Nos. 0 to 6, 3/4 in. to 2 in. long

PUMICE POWDER

RIVETS
- *a*) Copper, with burrs, Nos. 7 to 14, lengths, 3/8 in. to 3/4 in., selected sizes
- *b*) Iron, No. 14 gauge to 3/16 in., flathead or button head, 1/4 in. to 1 in. long, selected sizes
- *c*) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
- *a*) Molding, in 350-lb. barrels or 800-lb. casks
- *b*) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
- *a*) Flathead or roundhead iron brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds
- *c*) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
- *a*) Bessemer, rod, 1/64 in. to 3/8 in. by 64ths, in 4-ft. lengths, selected sizes
- *b*) Bars, cold rolled, 1/8 in. to 3/8 in. thick, 1/2 in. to 2 in. wide, 12-ft. lengths, selected sizes
- *c*) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
- *d*) Rods, hexagon and square, cold rolled, 1/4 in. to 3/4 in., in 12-ft. lengths, selected sizes
- *e*) Round, cold rolled, diameters 1/8 in. to 1 in., lengths 12 ft., selected sizes
- *f*) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
- *g*) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
- *h*) Threaded rods, Nos. 6 to 10, in 12-in. lengths, Nos. 12, 14, 1/4 in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
- *a*) Pigs, for casting alloys
- *b*) 1C, 1X, 20 by 48 in.
- *c*) 1XX, 20 by 48 in.

WASHERS AND BURRS
- *a*) Copper burrs, Nos. 3 to 14, in 1-lb. boxes
- *b*) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
- *c*) Brass washers, 3/16 in. to 1/2 in. by 16ths
- *d*) Iron washers, 3/16 in. to 1/2 in. by 16ths

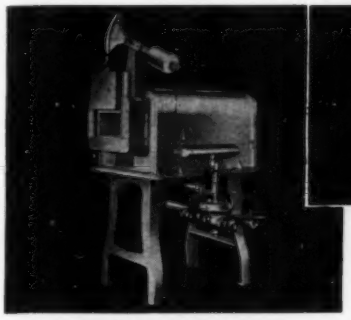
WELDING FLUXES

WELDING RODS (all rods come in 24-in. lengths)
- *a*) Brazing, 1/16-in., 1/8-in., and 3/16-in. diameter
- *b*) Cast aluminum, 3/16-in., 1/4-in., and 3/8-in. diameter
- *c*) Cast brass, 3/16-in., and 1/8-in. diameter
- *d*) Cast bronze, 1/4-in. diameter
- *e*) Cast copper, 3/16-in. and 1/4-in. diameter
- *f*) Cast iron, 3/16-in., 1/4-in., 5/16-in., and 3/8-in. diameter
- *g*) Low carbon steel, 1/16-in., 3/16-in., and 1/4-in. diameter

WHITE LEAD — for machine shop

WIRE
- *a*) Annealed, 16 to 34 W and M gauge, selected sizes
- *b*) Coppered market, 5 to 18 W and M gauge, selected sizes
- *c*) Coppered spring, 2 to 18 W and M gauge, selected sizes
- *d*) Galvanized, 5 to 18 W and M gauge, selected sizes
- *e*) Piano, Nos. 2/0 to 36, selected sizes
- *f*) Tinned, 16 to 24 W and M gauge, selected sizes
- *g*) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

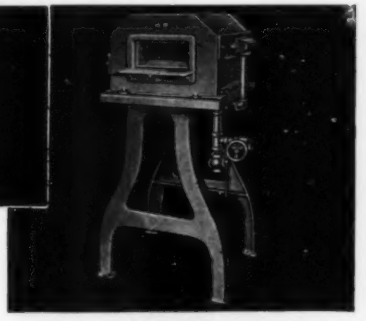
ZINC
- *a*) Pigs, for casting alloys
- *b*) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.



Small Semi-Muffle Oven

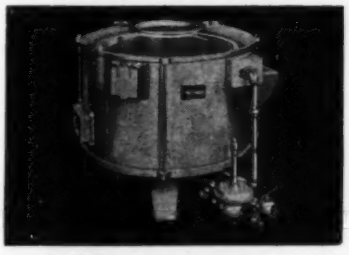
Sunbeam STEWART

THE BEST INDUSTRIAL FURNACES MADE



Small Forge

HUNDREDS OF THESE SUNBEAM STEWART FURNACES ARE IN THE VOCATIONAL DEPARTMENTS OF TECHNICAL SCHOOLS

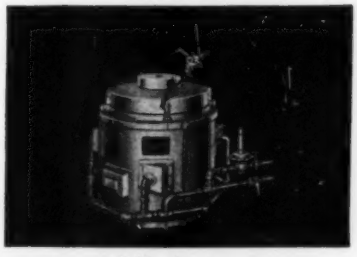


Round Pot Furnace

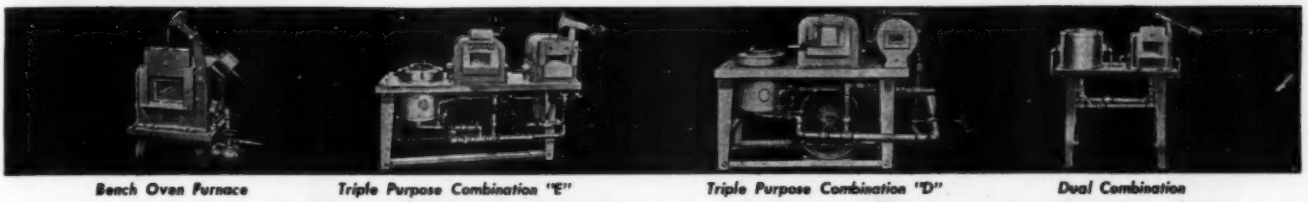
Because Sunbeam Stewart units have been designed for efficient production heat treating in small shops and tool rooms, they are widely recognized as standard equipment for all types of industrial heat treating and vocational training work. For student instruction and reference, write for our free "Guide to Furnace Selection." Aids in determining the type of furnace best suited for any work. Also ask for the new Data File on school units.

SUNBEAM STEWART INDUSTRIAL FURNACE DIVISION OF SUNBEAM CORPORATION (Formerly CHICAGO FLEXIBLE SHAFT CO.)

Main Office: 4433 Ogden Ave., Dept. 114, Chicago 23, Ill.
New York Office: 322 W. 48th St., New York 19, N. Y.



Melting Furnace



Bench Oven Furnace — Triple Purpose Combination "E" — Triple Purpose Combination "D" — Dual Combination

easier to use...

easier to teach

With the **Kalamazoo METAL CUTTING SAW**

Model 610 cuts 6" round and 6" x 10" flat. Coolant equipment is available

Here's the most popular metal cutting band saw used in industry. It will give you valuable assistance in teaching quality cutting and how to obtain it!

With a Kalamazoo, there's no burr . . . kerf is held to a minimum. And accuracy of a few thousandths can be maintained in cutting bars, rounds, angles and odd shapes.

Three sizes are available . . . each can be had with casters for complete portability. Write for complete information.

MACHINE TOOL DIVISION

Kalamazoo TANK and SILO CO.

319 HARRISON ST., KALAMAZOO, MICHIGAN

→See us at Booth 1019 — ASTE Convention.←

"it's easy to bend"

a new practical 32 Page diacro **BENDING MANUAL**

by the originators of "Die-less Duplicating"

This instructive and authoritative booklet will quickly prove itself indispensable wherever bending is done or is needed. It brings you a veritable gold mine of tested, authentic bending methods applicable to any rotary type bender. The proper bending technique may frequently offer a new approach to an old problem by simplifying product design and cutting production costs.

The exact methods of producing various types of bends in a wide range of materials are illustrated, step by step, with over 90 diagrams and charts together with valuable tooling suggestions.

You'll want a copy . . . Mail your request today.

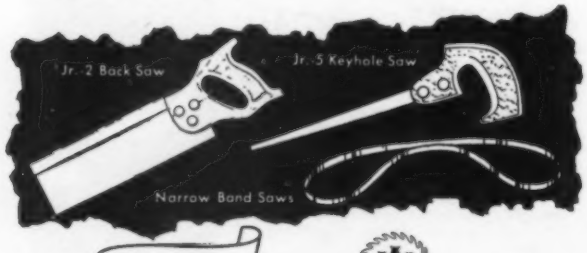
DIACRO DIE-LESS DUPLICATING

O'NEIL-IRWIN 351 8th Ave. Lake City, Minn.

ATKINS Complete Line of
"Silver Steel" JR. SAWS
Ideal for Students

ATKINS JR.-65

Whatever the purpose—there's an Atkins JR. saw to fit it! The complete JR. LINE—hand saws, back saws, keyhole saws—are exact counterparts of the world-famous line of ATKINS *REGULAR* saws, but with shorter blades and smaller handles *to fit any hand!* . . . Here are saws that stand the gaff—that deliver *plus* performance, year after year! They give students confidence—the "feel" of fine tool steel! Result: better work, easier teaching, higher class standing.



Use—Don't Abuse—Fine Tools!

ATKINS

ATKINS

E. C. ATKINS AND COMPANY
402 South Illinois Street • Indianapolis 9, Indiana

Speedmatic

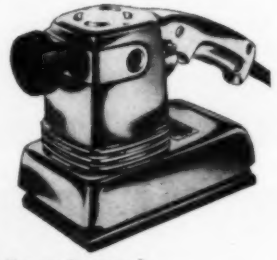
A BALANCED SANDER for every need!

PORTER-CABLE Guild

From light touch-up work to heavy-cut stock removal — there's a Porter-Cable sander for every job. Whether SPEEDMATIC or GUILD, each has perfect balanced design—a feature that assures true smoothness without ridges or gouging...less fatigue after long, steady use. Students readily develop the "expert touch" when finish-sanding.

For scores of school jobs
Combo-Tool (Model D-6)

Does high speed sanding, grinding, drilling, cutting, polishing on wood, metal, masonry. Wire brushes. Mixes paint. Can be purchased separately or complete with accessories in four different kits.

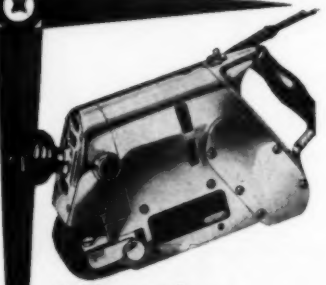


For project work
Guild Sander (Model 106)

Does fine finishing. Sands with, against, across the grain. Pad moves in ¼-inch orbits at high speed — no scoring; no pattern. Powerful AC-DC motor — 4000 rpm under load. Patented paper clamp holds abrasive flat and tight. Gearless — no lubrication. Low price.

Training, Maintenance
Speedmatic Model A-3

3" Belt. Does a super-smooth job of resurfacing table and desk tops, blackboards. Fits sash, screens, doors. Levels floor patches. A great time saver—a tool students will often meet in industry.



Widely versatile
Guild Model A-2

2" Belt. Designed for clean-up, leveling joints, fitting panels, edging plywood, removing paint, and light surfacing. Powerful and speedy—and the easiest sander in the world to handle.

See them at your dealer's. Write for detailed information

PORTER-CABLE Machine Co.
4123 N. Salina St. Syracuse 8, N. Y.
Manufacturers of SPEEDMATIC and GUILD Electric Tools
In Canada write: Strongridge Ltd., London, Ont.

ELECTRICAL SHOP

(Continued from page 29A)

in the clouds by a kite. He insulated himself from the string by tying a dry cloth between the string and his hand flying the kite. If there was really electricity in the air during a thunderstorm, he reasoned, it should travel down the wet kite string to the key, and then jump from the key to some object on the ground.

Franklin himself was that grounded object, and a spark jumped to the finger which he held close to the key.

Franklin then knew that the old superstitions were untrue! The experiment was a success. He had proved atmospheric electricity to be the same as electricity produced by friction. (The crackling noise when you comb your hair is the sound of electricity produced by friction. You are making miniature lightning and thunder, right on top of your head!)

Franklin, to fly a kite, must have been in an open field, or maybe on top of a hill. We now know lightning often strikes high objects in such places, without being further invited by a kite even higher in the sky.

Had Franklin been killed by lightning at that time, we might have lost years of progress in science and government.

The experiment led directly to the development of the lightning rod as protection against lightning. Through the years, this one device has greatly reduced property damage from lightning. (Lightning causes about $12,000,000 worth of damage to farm buildings each year, and causes more than half of all oil-tank fires.)

Later, Franklin was sent on several missions for the American Colonies. He was one of the signers of the Declaration of Independence. In fact, some people credit Franklin with originating the "idea" of the United States because he proposed unification of the colonies years before this was actually accomplished.

Two years after the birth of the United States, Franklin concluded our first foreign treaty. (It was with France.)

Then, he became "president" of Pennsylvania. The position corresponded to what we now call governor.

Before he embarked on his scientific and political career, Franklin wrote and published a best-seller, *Poor Richard's Almanac*. Of the many valuable contributions he made to the world, this is the only one we might know today, had Franklin lost his life while studying nature's powerful killer — *Lightning*.

Special Note to Kite Flyers

Enjoy flying kites but *don't* try it in a thunderstorm as Franklin did. It is also an unhealthy idea to use a coil of wire instead of string for flying your kite. If the wire should happen to cross an electric power line, it might put you in the circuit, and you aren't made to withstand 110 volts, to say nothing of the 20,000 volts and higher used for cross-country power transmission.

For additional reading:

Cobham E. Brewer, *A Dictionary of Phrase and Fable* (Philadelphia: J. B. Lippincot Co., 1929), p. 668.

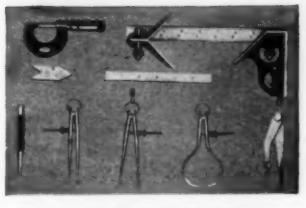
Gilbert D. McCann, *Today's Ben Franklins* (Pittsburgh, Pa.: Westinghouse Electric Corporation, 1945).

Magnetism — Goat's Blood on the Compass

Have you ever magnetized the blade of your pocketknife, so it would pick up pins and tacks? If you have, you know that the strength of the "magnetic blade" gets

Starrett

YOUR PARTNER IN PRECISION



PRECISION TOOLS

Starrett Catalog No. 26 "CE" shows many tools and kits of tools especially suited for school shop use . . . the same fine tools used by skilled mechanics. Write for your copy.

STARRETT SET OF TOOLS No. 902B

The essential measuring tools for modern class projects. Includes 1" micrometer, combination square with center head and 12" blade, center gage, center punch, 6" flexible steel rule in pocket case, 4" divider, 4" inside caliper, 4" outside caliper and 4" hermaphrodite caliper — in a compact folding case.

HACKSAWS

Precision made in a new, modern plant by the World's Greatest Toolmakers in all standard sizes for cutting metal by hand or machine. Write for Starrett Hacksaw and Band Saw Book.

BAND SAWS

For cutting metal, wood, plastics, etc. Available in coils of any length or cut to length and welded. Also Band Knives for cutting soft or fibrous materials.

BLUE PRINT SETS

Fourteen blue-printed 8"x 10½" punched notebook sheets, each illustrating an important tool and its uses. Furnished to instructors at cost — 15 cents per set.

THE STARRETT BOOK FOR STUDENT MACHINISTS

Widely used as a shop class text book. Provides essential information about tools, machines and modern methods in simple shop language. 200 illustrations, 30 reference tables. Only one dollar per copy.

Starrett

SINCE 1880 WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY · ATHOL, MASS., U.S.A.

BUY THROUGH YOUR DISTRIBUTOR

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK HACKSAWS, BAND SAWS and BAND KNIVES

ELECTRICAL SHOP

(Continued from previous page)

weaker and weaker as you use your knife for cutting, until it is no longer a magnet. To strengthen it, would you wash the knife in nice, warm goat's blood?

That's what people used to do! Of course we know better now, but let's go back and find out about some of these early ideas about magnets and the compass.

According to early legend, a shepherd who lived in the country of Crete, found that the iron tip of his staff and the nails in his sandals were attracted to the earth by a certain kind of rock. Magnes, the shepherd, was the first to discover a natural magnet.

Men were curious about this stone, and found it an amusing plaything. Then, one day, someone noticed that if a long piece of this rock were hung in the air, free to turn, that it would always point toward the north.

This led to the first practical use of this magnetic rock — a compass to point out directions. It became known as the *leading stone* or *loadstone,* for short.

One of the first stories about the loadstone comes from China. Nearly 5000 years ago, the Chinese Empire was founded by a man named Hoang-ti. He reigned 100 years and lived to be 121 years old. But during his reign, his empire was torn by fighting and strife. Once the troops of Hoang-ti were pursuing a rebellious prince, and were lost in a dense fog which rolled in from the broad plains which they were crossing.

In danger of losing sight of the prince, Hoang-ti ordered that a chariot be built. Upon it was placed a model of a female figure with an arm, made of loadstone, extended, pointing. The figure was pivoted on its base, free to turn. Then, no matter which way the chariot was driven, the arm of the figure always pointed south. (The Chinese considered that the compass pointed south, instead of north as did the Europeans, and as we do today.)

P.S. Hoang-ti captured the prince.

The magnetic compass may not have been constructed until about 1500 years later, by Ki-tan, who was a Chinese Minister of State. But it is quite definite that the honor of having made the first use of the loadstone belongs to the Chinese. They were also the first people to find useful methods of making pieces of iron and steel magnetic. This process is called "inducing" magnetism. Iron and steel are not natural magnets as is the loadstone.

Sailors from Europe made use of the loadstone and later, magnetized iron and steel for their compasses. Before using the compass to tell directions, they used only the stars. So important were the stars to the sailors that they believed the compass pointed north because it was attracted by the North Star.

(The stars are still one of our most accurate ways of finding an exact location on the surface of the earth. But the compass is much easier to use for short distances, and as a steering aid between readings of the stars.)

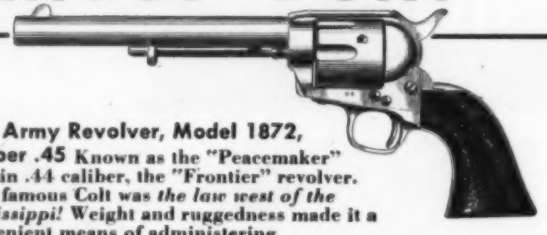
The use of the compass aboard ship grew steadily, and finally, about 300 years before Columbus sailed to America, the compass was in common use on ships.

The sailors believed the compass was so important that they made heavy penalties against anyone who damaged it.

One old sea code provided that anyone who tampered with the compass would be

(Continued on page 40A)

Famous Guns



Colt Army Revolver, Model 1872, Caliber .45 Known as the "Peacemaker" and, in .44 caliber, the "Frontier" revolver. This famous Colt was *the law west of the Mississippi!* Weight and ruggedness made it a convenient means of administering a "pistol whipping".

Model 1808 Navy Pistol, Caliber .64, made by Simeon North of Berlin, Conn. Boarding pistols like this rendered valuable service in the War of 1812. In building them, North actually used a modern mass production technique—*standardized parts!*

Instant-heating

Weller Guns simplify soldering instruction, save time and current. Switch instantly to high or low heat as job requires. Pre-focused spotlights end "blind soldering". Exclusive tip-fastening arrangement assures full, constant heat. Perfect balance aids handling skill. Dual heat adds greatly to life of low-cost replaceable tips. High-impact plastic housing. Weller Guns pay for themselves in a few months. See at your Distributor or write for Bulletin direct.

Get SOLDERING TIPS, new Weller Handy Guide to faster, easier soldering. 20 pages, fully illustrated. Price 10c at your Distributor, or order direct. Special discount for classroom quantities.

Weller

BETTER FROM GRIP TO TIP!

SOLDERING GUNS 811 Packer Street, Easton, Pa.

The Finest Soldering Tool for the Finest Craftsmen

Plan LOW-COST, HIGH-INTEREST SHOP PROJECTS WITH CADILLAC PLASTICS' SPECIALLY PRICED

PLASTIC ASSORTMENTS FOR SCHOOL SHOP USE

PLEXIGLAS • LUCITE • CEMENTS • DYES

No other materials offer students so wide a range of things to make. Plastics can be cut, drilled, machined, formed and shaped. And if you are cost conscious about the materials used in your school shop—here is the way to save MORE on all your plastics needs. These assortments of pre-cut sizes, shapes and colors, suitable for all projects, are priced at a fraction of the cost for plastics cut to order. Send for special price list. Today!

Buy NOW for The Spring Term!

Special Introductory Offer

COLORED PLEXIGLAS

Assortment includes translucent, opaque and transparent reds, blues, greens, greys, whites and others.

10 LBS. $9.50

All new, flat, paper masked Plexiglas and Lucite in the best colors. Finest quality in mixed sizes and thicknesses. Sizes 6" x 12" and larger.

CADILLAC PLASTIC CO.
15113 Second Blvd.
Detroit 3, Michigan

20 Lbs.	17.50
40 Lbs.	34.00
100 Lbs.	75.00

Cadillac Plastic Co.

AMERICA'S LARGEST PLASTICS SUPPLY HOUSE

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- a) 3 to 4 cu. ft., with tank, piping, and motor
- b) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- a) No. 100 or No. 125
- b) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- a) Cell tester, panel type with discharge rack
- b) Charger (15-battery size) with rack
- c) Charger (6-battery size)
- d) Gas stove (small)
- e) Lead-burning torches, with gauges and piping
- f) Plate racks

BENCH
- a) Electric test, elaborate
- b) Electric test, simple
- c) Work, with vises
- d) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- a) Adjusting stand
- b) Band-lining machine

BULLETIN BOARD

CABINETS
- a) Wood or metal, for bolts and supplies
- b) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- a) Teacher's
- b) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- a) Breast
- b) Hand
- c) Electric portable, ½ in.
- d) Electric portable, ¼ in.
- e) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- a) Cylinder, with motor
- b) 8 in., with motor
- c) 12 in., with motor

HONES — cylinder

JACKS
- a) Lever, 1½-ton
- b) Floor, roller

LATHE
- a) 11 in. by 4 ft., with motor, chucks, and attachments
- b) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- a) Arbor
- b) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- a) Electric steam for tube work
- b) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- a) Gauge
- b) Test table

Automotive Shop — Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- a) Cell tester, prod type
- b) Cell tester, cadmium
- c) Clips, large
- d) Element pullers
- e) Fillers
- f) Funnels, glass
- g) Hydrometer, acid
- h) Knives
- i) Post builders
- k) Post drills
- l) Post markers
- m) Separator trimmer

BITS
- a) Expansive
- b) Ratchet brace
- c) Wood, 5/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- a) Oil, ⅛ pt.
- b) 1 gal., gas, safety
- c) 5 gal., gas, safety
- d) 5 gal., kerosene
- e) Waste

CHECKS — tool, 1000, blank

CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 3/8 in., 5/8 in., ¾ in., 1 in.
- c) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- a) 1/32 in. to ½ in., by 64ths
- b) ½ in. to 1¼ in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- a) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- b) Half round, 6 in., 8 in., 10 in., and 12 in.
- c) Mill, 6 in., 8 in., 10 in., and 12 in.
- d) Round, 6 in., 8 in., 10 in., and 12 in.
- e) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- a) Air pressure
- b) Center
- c) Depth
- d) Thread
- e) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- a) Ball peen, 4 oz.
- b) Ball peen, 1¼ lb.
- c) Ball peen, 2 lb.
- d) Lead
- e) Riveting
- f) Sledge, No. 12

LADLE
- a) 3-in. bowl
- b) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- a) Outside, 0 to 1 in.
- b) Outside, 2 in. to 3 in.
- c) Outside, 3 in. to 4 in.
- d) Inside, 1½ in. to 6 in.

MOLDS
- a) Battery nut
- b) Battery post
- c) Battery strap
- d) Burning stick
- e) Lead hammer

OILSTONE

PIPE TAPS — ⅛ in., ¼ in., 3/8 in., and ½ in.

PLIERS
- a) Combination, 6 in.
- b) Flat nose
- c) Roundnose

PULLERS
- a) Bearing
- b) Gear
- c) Wheel, hub type

PUNCHES
- a) Center
- b) Taper pin
- c) Blacksmith

PUTTY KNIVES

(Continued on page 42A)

ELECTRICAL SHOP

(Continued from page 38A)

fastened to the mast of the ship by a dagger driven through his hand. The criminal would not be released, and could gain freedom only by tearing himself loose!

Great care was taken aboard ship to prevent garlic or diamonds from coming close to the compass. It was believed they would make the compass lose its magnetic properties. If such a tragedy should occur, however, a goat's blood bath was sure to restore the magnetism!

Current Electricity — It's Shocking

Did you ever give someone an electric shock by touching them after sliding your feet across a rug or floor? Your body stored electricity until there was enough to spark between you and the person you touched.

If you've had such an experience, maybe you can imagine what it would be like to carry a supply of electricity right with you, so you could shock others whenever you liked!

That's exactly what some South American fish do. The torpedo fish carries current generating cells along each side of its body. The electric eel, really a member of the carp family of fish, carries its battery in its tail.

We might compare these fish to a long flashlight, but instead of turning on a bright light, they give unsuspecting victims a paralyzing shock. Like any battery, continued use weakens the cells of these fish, and they must rest to recharge their batteries.

The torpedo fish can't move very fast, so it just lies on the bottom, waiting to electrocute or stun some passing fish or animal. The eel is also capable of killing

(Continued on page 44A)

up to 50% Greater Earnings

for Mechanics educated to the use of modern, time-saving tools!

● That is right . . . "Up to 50% greater earnings" . . . easily in reach of the youngsters who are receiving training today as the mechanics of tomorrow.

Sounds pretty strong! . . . *until you know the facts.* 30 years of unique, *first-hand* experience with the working mechanics of America have taught us the *facts* . . . given us countless case histories of the miracle that takes place in a man's productivity . . . *and his paycheck* . . . once he "sees the light" . . . and gives himself all the advantages modern tool equipment can provide.

It is a tradition (and a fact) that "good mechanics appreciate good tools."

It is a *far more important fact* that hundreds of thousands of man-hours (and pay-check dollars) are wasted *daily* through lack of the right tools for the job . . . *engineered* tools, fast, safe, energy-conserving, accurate!

Hard to believe *but we have seen* . . . again and again and again . . . young mechanics with brief experience *but excellent tool equipment* swiftly outstrip, in work and pay, able veterans who "didn't need all that stuff."

SNAP-ON TOOLS CORPORATION
8074-C 28th Avenue, Kenosha, Wisconsin

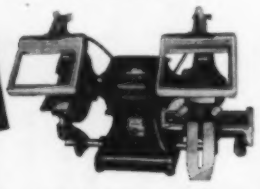
Send for **FREE** *Catalog*

The 104-page Snap-on catalog is a useful handbook of 4000 hand and bench tools for service maintenance and production operation. Free to instructors and school officials—write for it today.

Snap-on is the trademark of Snap-on Tools Corporation

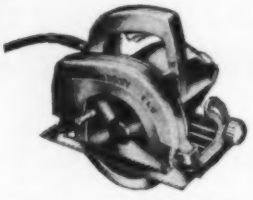
EQUIP NOW FOR THE YEARS AHEAD WITH STANLEY ELECTRIC TOOLS

DRILLS — available in 17 sizes in capacities to 1½". No. 24 shown, ¼" capacity.

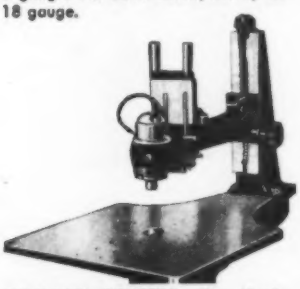


BENCH GRINDERS — for light or heavy duty. Six sizes from ¼ to 1 h.p. No. 677 Tool Grinder shown, ¼ h.p.

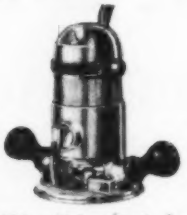
UNISHEARS — 10 models with capacities from 18 to 6 gauge. No. U218 shown, cuts up to 18 gauge.



SAWS — four sizes, 6", 7", 8", and 9". Many exclusive features. No. W65 shown, 6" blade.



OVERARM ROUTERS — for Maximum versatility. No. ORS5A-1 Combination Router and Shaper shown.

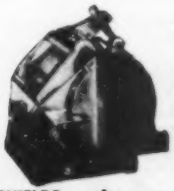


ROUTERS — high speed for precision work. Four models from ½ to 3 h.p. RS-8 shown, ½ h.p.

NO. 61 DOVETAIL ATTACHMENT — Dovetail joints easily accomplished with this Attachment and Stanley Router.

Equip your shop now with Stanley Electric Tools. Good equipment is necessary for the proper training for your students in the years ahead. The advanced design and quality construction of Stanley Electric Tools make them the ideal choice for all school shops. Reasonable first cost and long, steady performance assure maximum economy. Send the coupon today for the complete catalog. Stanley Electric Tools, Educational Department, 411 Myrtle St., New Britain, Conn.

STANLEY
Reg. U.S. Pat. Off.
Hardware • Tools • Electric Tools • Steel Strapping • Steel



EYESHIELDS — safer, more sanitary than goggles. No. 600 shown, 4" x 6" window, illuminated. Adaptable for use on most grinders.

Stanley Electric Tools, Educational Dept.
411 Myrtle St., New Britain, Conn.

Gentlemen: Please send me your complete catalog of Stanley Electric Tools.

Name.....
School.....
Street.....
City & State.....
Subject you teach.....

(Continued from page 40A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ½ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *j*) Valve-tappet wrenches

Automotive Shop — Materials and Supplies

ABRASIVE CLOTH AND PAPER — aluminum oxide and silicon carbide
ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
- *a*) 600W
- *b*) Penetrating

BOLTS
- *a*) Machine, selected sizes
- *b*) N.F. selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSENE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated. square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

TRAIN THEM WITH EQUIPMENT
PREFERRED BY THE INDUSTRY

CURTIS PRECISION-BUILT AIR COMPRESSORS · AUTO LIFTS CAR WASHERS

98 Years of Manufacturing "Know-How"

AIR COMPRESSORS
¼ THROUGH 10 H.P.

Dependable, trouble-free performance —

Timken roller main bearings

Positive unloaded starting

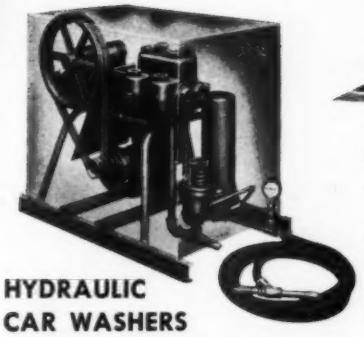
"Centro-Ring" lubrication

ASME tank — Deep penetrating welds

Other Curtis Products

LARGE VOLUME AIR COMPRESSORS, up to 50 H.P. — water cooled.

AIR HOISTS AND AIR POWER CYLINDERS — for low cost material handling, pushing and pulling operations.

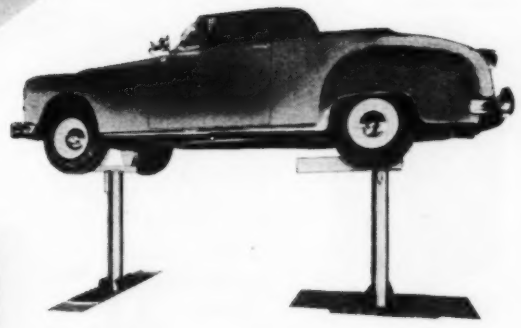


HYDRAULIC CAR WASHERS
(300 Pounds Pressure)

More cars can be washed cleaner in less time with this silent, self-oiling power washer.

For complete information on any of these products, mail a post card to Curtis listing the products in which you are interested.

CURTIS
PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1909 Kienlen Ave. · St. Louis 20, Mo.

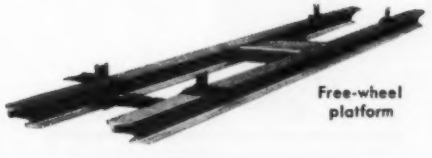


FULL HYDRAULIC TWO-POST SHOP LIFT

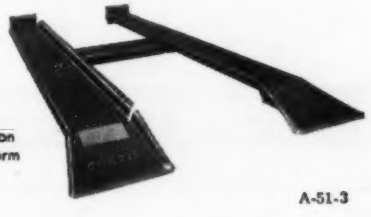
Complete accessibility for better, faster work — Ample lifting height — Provides safe pick-up — 60" wheelbase range — Minimum installation cost.

SINGLE POST LIFTS —

Full and semi-hydraulic



Free-wheel platform



Roll-on platform

A-51-3

ELECTRICAL SHOP

(Continued from page 40A)

animals of considerable size. It can produce, for about three millionths of a second at a time, the power required to illuminate 30 ordinary 60-watt light bulbs!

While not good pets, these fish are considered edible delicacies by some natives in Brazil. Horses are driven into the water so that the eels will discharge their batteries attacking the horses. Thus rendered ineffective, the eels may then be picked up safely and prepared for eating.

Today's modern compasses are a far cry from the first crude piece of stone picked up on the Isle of Crete 5000 years ago. It has become one of the most used instruments in the world. It is found on ships, in airplanes, and even in automobiles. And a compass is required equipment for the safety of every adventurous boy or hunter.

For additional reading:

Ralph A. Richardson, *Electricity and Wheels* (Detroit: General Motors Corporation, 1939).

A Chronological History of Electrical Development (New York: National Electrical Manufacturers Association, 1946).

A. H. Haustrath, Jr., and J. H. Harms, *Consumer Science* (New York: The Macmillian Co., 1939), p. 169.

Dwight E. Gray, *Man and His Physical World* (New York: Van Nostrand Co., Inc., 1947), p. 428.

A full powered four-foot eel may have 240 cells, each capable of delivering almost a volt. The resulting shock of several kilowatts can paralyze a man's leg for hours. In fact, some mysterious drowning accidents have been blamed on these shocking fish.

The upper side of the torpedo fish is the positive pole and the lower side is the negative pole of this swimming battery. Out of the water, it must be touched in two places to make a complete electric circuit. Salt water is such a good conductor, however, that only one point of contact is required when in water.

(Since water is such a good conductor of electricity, it should not be used to put out a fire on electrical equipment until the current has been turned off at the switch.)

For thousands of years these fish held the mystery of chemically produced electricity. It wasn't until Volta built the first battery in 1798 that man finally caught up with nature!

For additional reading:

"Electric Eel," *Compton's Pictured Encyclopedia and Fact-Index*, Vol. 4, 1949, pp. 191–192.

"Torpedo Fish," *Compton's Pictured Encyclopedia and Fact-Index*, Vol. 14, 1949, pp. 113–114.

C. F. Kettering, "Underwater Powerhouse," *Short Stories of Science and Invention* (Detroit: General Motors Corp.), pp. 108–109.

Current Electricity — Dancing Frog Legs

For centuries the electric eel and torpedo fish held the secret of electricity produced by chemical action. Not until 200 years ago did man suspect this possibility. A scientist named Luigi Galvani one day noticed that a pair of frog legs, which he had hung on a wire, were twitching and wiggling. He experimented further. When he connected one kind of metal to a nerve and another kind of metal to a muscle, he found that a very tiny current flowed when the wires were connected together.

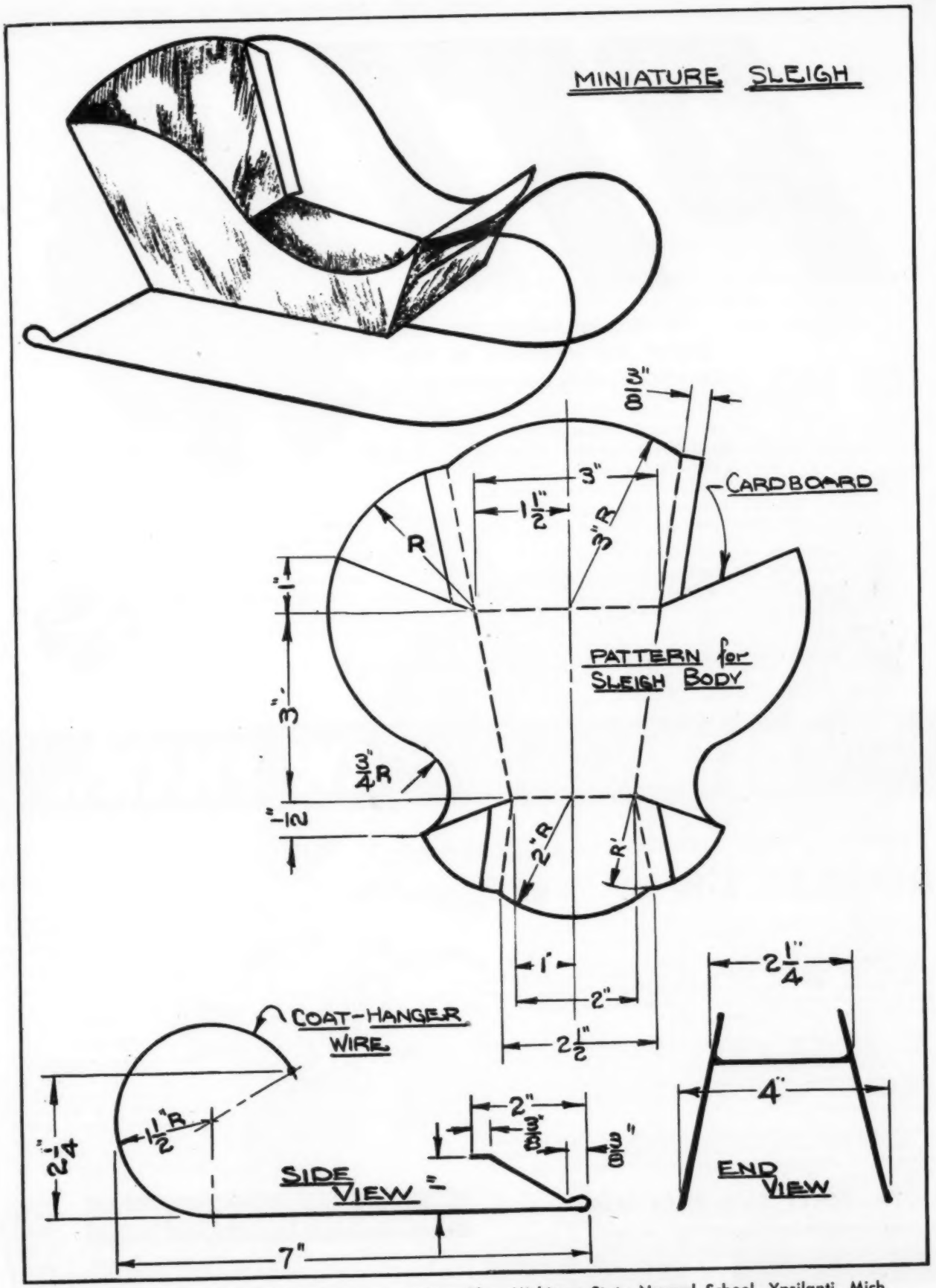
Galvani knew there were two explanations possible. Current was either caused when two unlike metals came in contact, or animal tissue supplied the current.

He thought it was the animal tissue, and became so convinced in his own mind that he failed to reason scientifically when later information indicated his first conclusion was wrong!

Alessandro Volta proved that electric current could be produced from two dif-

(Continued on page 47A)

PRACTICALLY EVERY PRINTING PLANT IN THE WORLD USES ONE OR MORE OF THESE
Rouse PRODUCTS
For absolute accuracy and extra profits, order Rouse time-saving equipment. Write for complete illustrated catalog—today!
No. 40 Lead and Rule Cutter
Slug Clippers
No. 2 Band Saw
Register Quoins
Hand Miterer
Economy Vertical Miterer
Composing Stick
Make-Up Rule
Line Gauge
Sennett Positive Assembler
Newspaper Wall File
Lino Slug Cutter
Type Mortiser
Form Truck
Tympan Paper Holder-Vertical or Horizontal
Press Seat
H. B. ROUSE AND COMPANY
2214 NO. WAYNE AVE. • CHICAGO 14, ILLINOIS
50 YEARS OF SERVICE TO THE PRINTING INDUSTRY



Miniature sleigh submitted by George A. Willoughby, Michigan State Normal School, Ypsilanti, Mich.
— Drawing by Norman Risk, Michigan State Normal School, Ypsilanti, Mich.

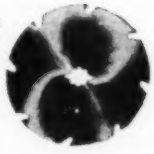
PTI

The original safety saw blade tested and approved by the world's leading laboratories

School shops all over the country are using and approving this remarkable new Safety Saw Blade. It is the first blade of its kind—thoroughly tested by leading laboratories and industrial concerns. You can depend on the PTI blade to minimize the danger of "kick-backs" from circular sawing.

Precision-made from chrome vanadium steel by one of the world's leading saw blade manufacturers. Available in sizes from 7" to 16". (U.S. Patent No. 2,559,355.)

- ***Gives added protection to saw operators***
- ***Cuts cleaner—produces chips, not sawdust***
- ***Cuts much quieter***
- ***Costs no more than ordinary blades***



NEW! PTI Safety Blade *for Portable Saws. Fits most standard makes. Write for circular.*

INCORPORATED • 401 Broadway, New York 13, N. Y.

Preston PTI Sales and Service, Preston, Ontario, Canada

FOLEY *Automatic* SAW FILER

Trains Your Students Better - - DOUBLES Life of Your Saws

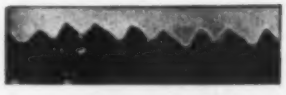
"ONE OF THE BEST MACHINES WE HAVE FOR TRAINING PURPOSES" — Samuel Gompers Trades School, San Francisco

The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cut circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer.

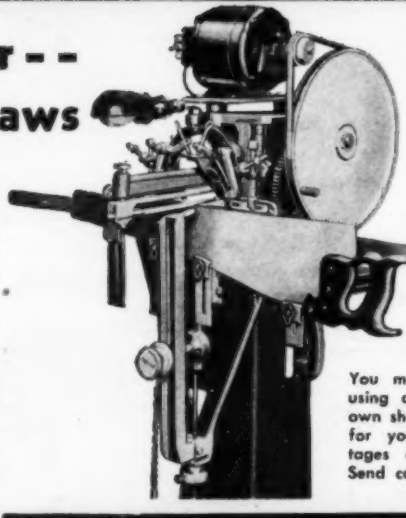
With a Foley Automatic Saw Filer you can sharpen your saws more perfectly than is possible by hand. You can do it quicker, — and your saws will stay sharp longer. Your students will turn out better work with sharp saws. ALSO by keeping your saws sharp with a Foley, — you will easily double their cutting life and have less breakage, reducing replacements to a minimum.

Train your students to file saws on a Foley, for they will find thousands of Foley Saw Filers used in industry, Army, Navy, Air Corps, etc. Hundreds of schools and colleges use them to save on saw filing costs and replacement expense.

The FOLEY SAW FILER Makes . . .



an OLD SAW . . . . . LIKE NEW!



TYPICAL SCHOOL USERS

Berea College, Berea, Ky., Board of Education, Cleveland, Ohio; Boys Technical H. S., Milwaukee, Wis.; Charleroi School District; Charleroi, Pa.; Redlands Public Schools, Redlands, Calif., Stout Institute, Menomonie, Wis.

30-DAY TRIAL OFFER

You may have the privilege of using a Foley Saw Filer in your own shop for 30 days, — and see for yourself its training advantages and operating economies. Send coupon for details.

Send in this Coupon

FOLEY MFG. CO., 3318 N.E. 5th Street Minneapolis 18, Minn.
Please send literature on the Foley Automatic Saw Filer and details of your 30-Day Trial.

Name.....

Address.....

ELECTRICAL SHOP

(Continued from page 44A)

ferent metals held close together. He tried metals without animal tissue present. Volta made the first man-made current electricity by piling alternately plates of silver and zinc, separated by cloth soaked in salt water. The apparatus named for its inventor is called the voltaic pile, and the volt, which is today our standard unit for expressing electric pressure, is named for Volta.

You can very quickly make a simple voltaic pile in the shop or laboratory. Just soak a blotter in salt water or sal ammoniac liquid (the same that you use for cleaning soldering coppers). Saliva will work, but is not as hygienic. Put pieces of the blotter between pennies and dimes laid alternately. A galvanometer will detect the current produced.

Volta's discovery led to the beginning of one of our great industries of today — the manufacture of batteries. Today, batteries are found in many shapes and sizes, from the large cells in the battery of your car to the cells smaller than a thimble in Walkie-Talkie batteries. And batteries are used anywhere a portable source of electricity is needed.

Try making a miniature battery in your mouth, if you have some silver fillings in your teeth. Bite on a piece of tin foil! The silver filling and the tin foil are the *two unlike metals*. Your saliva is the *"electrolyte,"* the moist material which separates the plates of a battery. Feel anything?

We know today that two different metals separated by a moist electrolyte produce electricity by chemical action. But even though he made the wrong conclusion, we owe much to the alert, observing Luigi Galvani and the twitching frog legs!

Current Electricity — The Lazy Man's Dream

It has been said that the way to find the simplest, quickest way to do something is to have a lazy man do it! He will save himself all the effort he can and yet do the job.

The lazy man may have dreamed about all the marvels of electric power, but only hard work made them a reality. The steps that lead to any great advancement in our civilization are experimentation, perhaps failure again and again, until finally success is achieved, and then intelligence enough to make use of the facts discovered.

Many hard-working, alert men laid the foundation for our modern power system. Franklin demonstrated that electricity exists in two forms, positive and negative. Volta made the first battery. Faraday produced the first electric generator. Henry made the first electric motor. Finally, enough was known about electricity that the public was able to use it.

Direct current (d.c.) distribution systems were built years before alternating current (a.c.) was available. Less than two generations have passed since the world's first power company in New York City began to supply power to a few light bulbs (Edison's Pearl Street Station).

But d.c. wouldn't travel great distances. The generator had to be close to the user of the current. Electricity could not be sent economically for more than a few miles.

Finally about 60 years ago, George Westinghouse built the first alternating current distribution system in a Massachusetts town (Barrington). The generator could be located near water power or a

(Continued on next page)

modernize your machine shop now

install America's no. 1 machine tool drive...

Progressive schools everywhere are selecting LIMA DRIVES to modernize their present lineshaft driven machine tools — economically.

Photo above shows the installation of LIMA GEARSHIFT DRIVES at the Syracuse Vocational High School, Syracuse, New York.

LIMA DRIVES with all working parts enclosed, provide the utmost in functional safety, as well as adequate lighting, proper machine location and complete elimination of hazardous lineshafting.

Complete engineering facilities available

WRITE FOR LITERATURE

LIMA

Representation in principal cities

GEARSHIFT DRIVES & MOTORS

THE LIMA ELECTRIC MOTOR COMPANY 3447 FINDLAY ROAD, LIMA, OHIO

ELECTRICAL SHOP

(Continued from previous page)

cheap source of fuel, and the electricity could be transmitted by wire over great distances.

With this long distance transmission possible, industry began using a separate electric motor for each machine. Then, a breakdown in one part of the factory did not require that all machines be stopped during repairs. Such halts were required when power was sent to all machines by overhead belts and pulleys. Then too, each factory no longer needed its own steam or waterpower plant.

As the advantages of electric power became known, the electric industry grew. Today the United States uses nearly half the electricity made in the whole world!

In terms of industrial production, this explains why the United States has the highest standard of living in the world. One man operating a machine can produce 70 times as much as a man using muscle power. The average workman in a manufacturing industry uses more than 10,000 kilowatt hours of electricity each year. For the same period, this electricity would supply the needs of seven average homes.

About two thirds of the electricity used in the United States is used in industry. No wonder we produce more than half the world's goods. Yet, the U. S. has only 7 per cent of the world's population.

Our power distribution has expanded so much that nearly everyone can now have electricity in his home if he wants it. Virtually all cities and towns have electric power, and electricity has now reached three fourths of the nation's farm homes.

Electricity has eased our work and yet made it possible for us to do more work at a cost far less than cost of human labor. We in the United States, only a small part of the whole world's population, make more goods and live better than any other people in the world! Electricity helped. But it was hard-working, straight thinking men who made all these wonders possible.

Just because we have more electric power than other people does not give us the right to waste it; we must conserve electricity just as we must conserve other materials and resources.

There is one exception! Nature's electricity, lightning, is better wasted. We are letting this vast amount of electricity go unused. Even if technical development could make it possible to safely harness lightning, the power would be almost worthless! The biggest flashes, which break trees and buildings, and create those deafening noises, possess only a few cents worth of electricity.

Man has learned to make electricity better than nature!

While man did not invent electricity, he did devise the methods of controlling it for useful purposes.

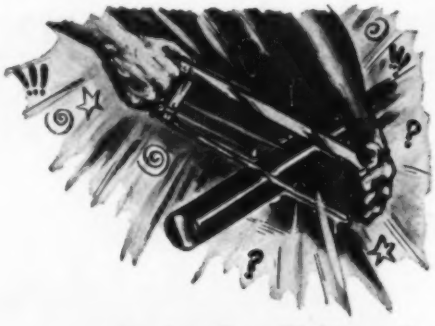
Franklin, Edison, Morse, Henry, Marconi, Westinghouse, and all the others who have furthered our knowledge have been a benefit to mankind. Electricity, because of them, provides jobs for thousands of people. Each new use for electricity creates more jobs.

Don't be a lazy man, dreaming. Whether or not you choose an electrical job for your lifework, be useful in the job you choose. Do something for mankind. You'll feel wonderful!

For additional reading:

"The Dawn of Electrical Power," *Westinghouse Historical Series No. 14* (Pittsburgh, Pa.: School

(Continued on page 50A)



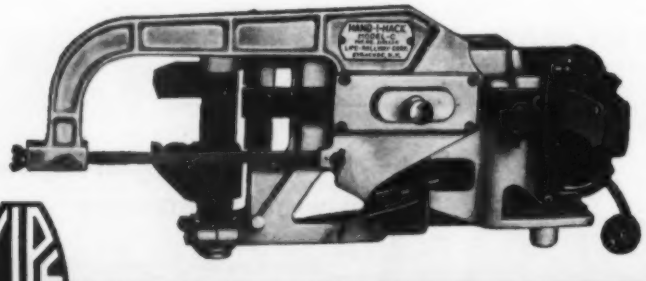
NO MORE
hacksawing drudgery that everybody hates.

NOW!
HAND-I-HACK*
*Trade Mark Reg. U. S. Pat. Off.

PORTABLE POWER HACK SAW

Hand-I-Hack is the ideal hacksaw machine for school shops. It is extremely accurate in performance. It requires little room, is moderate in first cost and operating expense.

Hand-I-Hack is very rugged and simple to understand and use. It will work in any position and will handle practically every job encountered in a school shop. Capacity 3" x 3". Uses low-cost 10" hand blades which last 3 to 5 times longer. *Instructors:* Write today for full information. *School Shop Dealers:* Write for our dealer proposition.



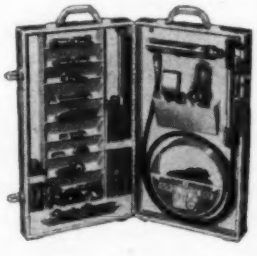
Lipe-ROLLWAY CORPORATION
814 Emerson Ave. Syracuse, N. Y.

MORE AND MORE SCHOOLS TEACH

Porto-Power METHODS...

7 BIG REASONS WHY

"Porto-Power" is a combination of a specialized hydraulic jack and attachments which can be adapted to push, pull, press, clamp, spread and bend. Easy strokes on the hand pump transmit oil under pressure to the compact ram — which operates at any angle.



A POPULAR KIT FOR SCHOOLS is this SA-18 "Bantam Porto-Power" Assortment. Its hydraulic unit has a 2-ton capacity which handles 90% of all body panel rebuilding requiring hydraulic power. The kit includes 23 attachments. Other "Porto-Power" units are available (in 2, 7, 10, 20 and 50-ton capacities) for schools with large budgets. The SA-18 "Bantam" Kit is a practical, basic minimum to demonstrate "Porto-Power" methods.

1. **"Porto-Power" is the easiest, most simple** hydraulic service equipment to use . . . causing its popularity in both schools and actual service.
2. **Students learn to operate what they later will employ in their work.** It is by far the most popular hydraulic service equipment.
3. **Only "Porto-Power" serves the full range of automotive rebuilding jobs.** Rebuilding operations are a major phase of automotive service.
4. **Only "Porto-Power" offers hydraulic tools for general automotive repair work.** It is thus important to students who will specialize in general repair service.
5. **Implement and tractor maintenance** requires "Porto-Power." Its use is promoted by leading tractor manufacturers.
6. **"Porto-Power" is popular in industry** — for maintenance and production. It is also important in laboratory and construction operations.
7. **"Porto-Power" is a major tool in the electrical field** for installation of pipe and conduit and in other electrical construction and maintenance.

BUY BLACKHAWK PRODUCTS FROM YOUR HOME-TOWN AUTOMOTIVE JOBBER. Also, leading Industrial Supply Distributors are a source for Blackhawk Industrial equipment. IMPORTANT! Only Blackhawk makes "Porto-Power!"

BLACKHAWK

HYDRAULIC JACKS — Blackhawk offers the preferred and most complete line of Hand and Service Jacks.

'RECK-RACK'—This low-cost device rigidly holds body sections for off-the-car roughout and metal finishing.

WRENCHES—Save up to 40% on socket wrenches —yet equip students with the world's finest professional tools.

FREE—Kit of Blackhawk literature for vocational school *instructors*. Helpful as text material and for selection of vital shop equipment. Includes free blueprints showing how you can build your own press.

BLACKHAWK MFG. CO., Dept. P3331 Milwaukee 1, Wis.
Send free kit of instructor's literature.

Name .....

Position .....

School .....

Address .....
Street City State

Electrical-Shop Equipment, Supplies, and Motor Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, $1\frac{1}{16}$ in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, $\frac{1}{32}$ in. to ⅜ in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for Pipe threads, ½ in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop — Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — Carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — ⅜ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–40 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ⅜ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ⅜ in., 10–24 by ⅜ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–40 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- *d*) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2 oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.
STARTING BOXES
- *a*) For compound motors, various makes
- *b*) For shunt wound, 1 h.p., 110-volt motors. Overload release
- *c*) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- *d*) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt
SWITCH
- *a*) Battery, 4 point
- *b*) Bases. porcelain, for 10-amp. switches

(Continued on page 52A)

ELECTRICAL SHOP

(Continued from page 48A)

Service, Westinghouse Electric Corporation).

"A 200,000 Product Company," *Life*, Vol. 25, No. 14 (October 4, 1948), pp. 81–88.

The Story of Lightning (Schenectady, N. Y.: General Electric Company).

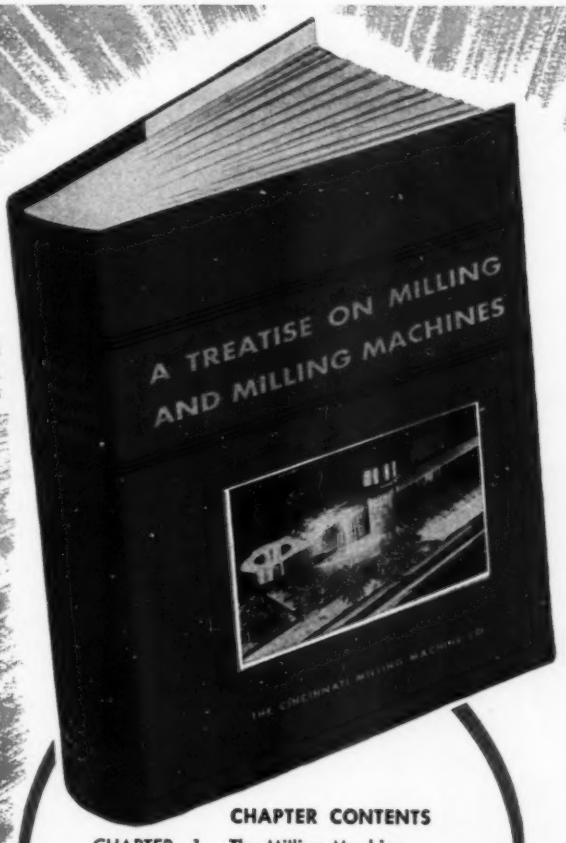
Electromagnetism — The Third Greatest Force in the Universe

Magnetism has been important to man for thousands of years. Until the past century, however, the compass was the main useful application of magnetism. Magnetism was well enough known, however, that it was mentioned in the legends of the time.

In many stories, like those of Sinbad the Sailor, a magnetic mountain was described which supposedly drew out the nails of any ship which approached, sending it to the bottom. Of course, any magnetic force from a mountain would be comparatively small, but it made a good story!

(There is a real magnetic mountain in

(Continued on page 52A)



EVERY MACHINE SHOP INSTRUCTOR SHOULD HAVE THIS BOOK . . .

A wealth of information about modern milling machine practice is contained in the new book illustrated here . . . "A Treatise on Milling and Milling Machines," published by The Cincinnati Milling Machine Co. It is written in regular textbook style, devoid of advertising.

The book is 6¼" x 9¼" in size, case bound, and contains 896 pages of text. There are 200 formulae to solve various problems encountered in shop practice, and over 700 illustrations and charts. A conception of the magnitude of this book may be realized by glancing through the table of contents at the left.

Fill in the coupon and mail it today. Enclose check or purchase order. Price of book $8.00 per copy (postage, sales and local taxes included).

CHAPTER CONTENTS

CHAPTER 1	The Milling Machine
CHAPTER 2	Milling Machine Accessories
CHAPTER 3	Milling Cutters
CHAPTER 4	Milling Cutter Materials
CHAPTER 5	Milling Cutter Elements
CHAPTER 6	Sharpening and Care of Milling Cutters
CHAPTER 7	The Milling Process
CHAPTER 8	Chip Formation, Surface Finish, and Cutting Fluids
CHAPTER 9	Power Required in Milling
CHAPTER 10	Mounting of Milling Cutters
CHAPTER 11	The Milling Machine in Toolroom Work
CHAPTER 12	The Use of Work Indexing in Repetitive Milling Operations
CHAPTER 13	Milling of Helical Surfaces
CHAPTER 14	Milling Cams and Other Surfaces of Curved Contour
CHAPTER 15	Milling Dies, Molds, and Parts of Cylindrical or Irregular Contour
CHAPTER 16	Diversified Uses of Milling Equipment in Toolroom Work and Inspection
CHAPTER 17	Production Milling
CHAPTER 18	Fixtures and Fixture Design
CHAPTER 19	Estimating Production Milling

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

THE CINCINNATI MILLING MACHINE CO.
DEPT. VE, 4701 MARBURG AVE., CINCINNATI 9, OHIO

Please send_____copies of "A TREATISE ON MILLING AND MILLING MACHINES" at $8.00 each (postage, sales and local taxes included).

NAME_____
(Please Print)

COMPANY_____

STREET AND NO._____

CITY_____ ZONE_____ STATE_____

(Continued from page 50A)

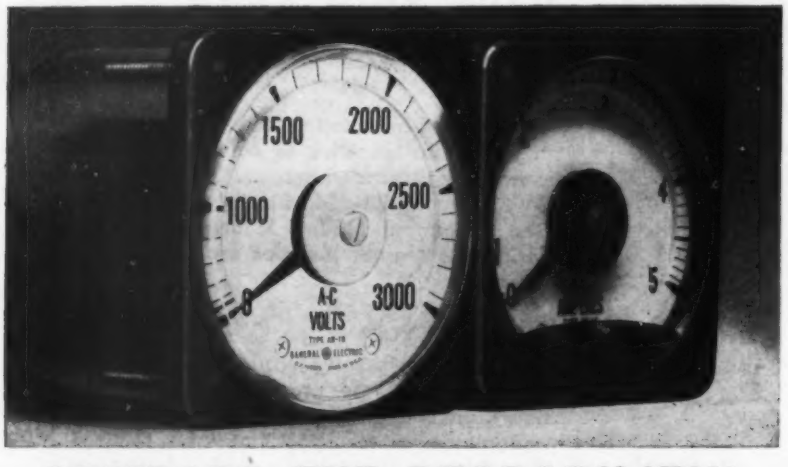
c) Boxes, 2¾ in. deep
d) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
e) Entrance, safety, 3 pole, 30 amp., 250 volt
f) Flush, push button, S.P., D.P., 3 way, 4 way
g) Surface, S1, S3, and S4
h) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
j) Surface, snap, electrolier
k) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required
TACKS — double-pointed No. 10
TAPE
a) Friction, ½-lb. rolls
b) Rubber, ½-lb. rolls
TELEGRAPH SETS — including sounders, keys, and relays
TELEPHONES
a) Complete bridging, independent phones
b) Couch vestibule telephones
c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks
TRANSFORMERS
a) Bell ringing, 6, 8, 14 volt
b) Single phase, 110–220 volt, S.K.V.A.
TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.
TUBING — flexible nonmetallic, ¼ in. and ⅜ in.
WASHERS
a) Iron, ¼ in. and ⅜ in.
b) Brass, ¼ in. and ⅜ in.
WIRE
a) Annunciator No. 18 or No. 20
b) Fixture, No. 18, single yellow, with marker
c) Rubber covered, solid copper, No. 10, black
d) No. 10, white
e) No. 14, black
f) No. 14, white
g) Rubber covered, No. 16, brewery cord
h) No. 18, lamp cord, green and yellow
j) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

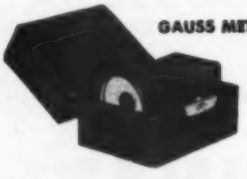
Electrical Shop — Motor and Testing Equipment

ANNUNCIATORS
a) Automatic needle drop
b) Gravity drop
c) Manual needle drop
ARMATURES — burnt out, for repairing

(Continued on page 54A)



COMPARE THE READABILITY!



For direct measurement of magnetic flux
- easy to use
- compact
- lightweight
- inexpensive

Standard kit includes gauss meter, reference magnet, and carrying case. Information on experiments is in bulletin GEA-777.

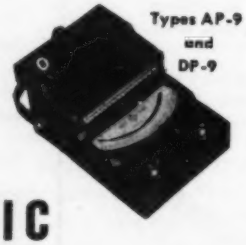
Shadow-proof dial makes new G-E instrument ideal for lecture-room demonstrations

- convex glass cover—maximum visibility
- scale surface flush with case front
- easier-to-read scale
- dustproof, moisture resistant case

AVAILABLE IN TWO SIZES: types AB, DB-16 is 8¾-in. square, 14.2-in. scale; type AB, DB-18 is 4¼-in. square, 7.1-in. scale. Both have 1% accuracy. Complete information in bulletin GEC-2188.

PORTABLE INSTRUMENTS For a-c and d-c measurements
- magnetic shielded
- dust-tight molded case
- fast reading
- dependable service

These sturdy, compact instruments are useful for general laboratory work. They are available in single, double, or triple ranges of voltmeters, ammeters, volt-ammeters, and single-phase wattmeters. Accuracy—¾ of 1%. Complete information in bulletin GEC-830. *Write Section F 687-66, General Electric Co., Schenectady 5, N. Y.*



GENERAL ELECTRIC

ELECTRICAL SHOP

(Continued from page 50A)

Russia. It is more than half iron! No wonder it attracts a magnetic needle and is called the magnetic mountain.)

About 100 years ago in Denmark, a scientist (Oerstad) found that there was a relationship between magnetism and electricity. An electric current will affect a magnetic needle like that used in a compass.

This knowledge led an Englishman to make the first electromagnet; the kind of magnet that is made by electricity flowing through a coil of wire. Finally an American (Henry) perfected the electromagnet. He insulated iron for a magnetic core, and surrounded it with a wire coil of many turns. By so doing, he increased the lifting power of his electromagnet from 9 to 3500 pounds. So well did Henry do his work, that even today, electromagnets are in nearly the same form.

Another American (Morse) used the electromagnet in his telegraph. Other uses for the newly discovered force soon followed.

Practically all electricity used today (except batteries) depends on electromagnetism, for it is by electromagnetism that we are able to generate power and run motors.

It is the backbone of industry. But it is even more fundamental than that. Electromagnetism is one of the three great forces in the universe! The other two are cosmic rays and gravitation.

Scientists are now trying to prove that electricity, electromagnetism, and gravity, all work under the same laws of nature.

When you play with a top motor or lift tacks with a nail wrapped with wire through which a current is passing, you are using electromagnetism — one of the three great forces in the universe!

(Continued on page 60A)

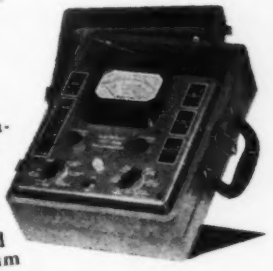
Dependable...Rugged INSTRUMENTS

for electrical and electronic instruction

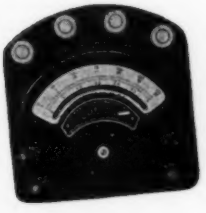
Standardize on WESTON instruments throughout your electrical courses, and thus be sure your students are thoroughly familiar with the instruments they will use all through their working careers. Accurate, economical, rugged and dependable—types available for all laboratory and classroom needs. Literature on request. WESTON Electrical Instrument Corporation, 601 Frelinghuysen Avenue, Newark 5, New Jersey.

ELECTRONIC ANALYZER

Three-in-one instrument. Provides self-contained Volt-Ohm-Milliammeter, high impedance electronic Volt-Ohmmeter, and probe type Vacuum Tube Voltmeter for use to 300 megacycles.



Model 769



Model 280

D-C MINIATURE INSTRUMENTS

Single and multi-range voltmeters, ammeters, voltammeters available. Accuracy within 1%. Hand calibrated scales. Knife-edge pointers, mirrored scales eliminate parallax errors.

SUPER-SENSITIVE ANALYZER

Volt-Ohm Milliammeter, 26 ranges, temperature compensated, D-C voltage ranges have either 1000 or 20,000 Ohms per volt sensitivity. Precision resistors used throughout. Solid oak carrying case. Small, light, compact.

Model 779

Model 697

VOLT-OHM-MILLIAMMETERS A-C D-C

Carefully selected group of ranges for A-C, D-C voltage measurements, direct current and resistance values. 1000 Ohms per volt sensitivity. Self-contained battery . . . equipped with test leads.

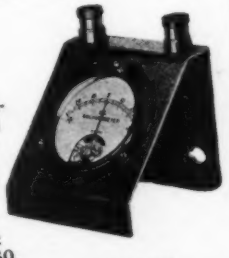
D-C PORTABLE INSTRUMENTS

Highly shielded single and multi-range voltmeters, ammeters, milliammeters and microammeters. Temperature compensated . . . hand calibrated mirror scales. Accuracy within ½ of 1%.

Model 931

STUDENT GALVANOMETER

Available with or without base. Widely used in school instruction where dependability and low cost are paramount. Sensitivity: 22 microamperes. Resistance: 23 Ohms. Scale: 30-0-30. Medium and extreme sensitivity models also available.



Model 375

D-C MINIATURE PORTABLE INSTRUMENTS

Rugged, serviceable for all-around use. Available in single, double, and triple ranges for voltage measurements; single and double ranges for current measurements. Accuracy 2%.

Model 489

WESTON INSTRUMENTS

(Continued from page 52A)

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- *a)* Air, single pole, overload, 25 amp., 550 volt
- *b)* Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- *a)* For multiple-speed motor
- *b)* For 1 h.p., 110-volt series motors

GENERATORS
- *a)* Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- *b)* Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- *c)* Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- *a)* Ammeter, standard, 60 amp., a.c.
- *b)* Ammeter, standard, 60 amp., d.c.
- *c)* Ammeter, student, 60 amp., a.c.
- *d)* Ammeter, student, 60 amp., d.c.
- *e)* Voltmeter, standard, 0–10 volt, d.c.–a.c.
- *f)* Voltmeter, standard, 110–220
- *g)* Voltmeter, standard, 125 volt
- *h)* Voltmeter, standard, 125 volt, d.c.
- *j)* Voltmeter, student, 110 volt, d.c.
- *k)* Voltmeter, student, 110 volt, a.c.
- *l)* Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- *m)* Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- *n)* Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- *a)* Auto starter, different makes
- *b)* Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- *c)* Compound, 1 h.p., 110 volt, d.c.
- *d)* Multiple speed, 1 h.p., 3 phase, 220 volt
- *e)* Series, 1 h.p., 110 volt, d.c.
- *f)* Shunt, 1 h.p., 110 volt, d.c.
- *g)* Split phase and repulsive, a.c., 110 volt, single phase, assorted
- *h)* Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- *j)* 3 phase, 1 h.p., a.c., 220 volt, various makes
- *k)* 3 phase, 2 h.p., 220 volt, a.c., various makes
- *l)* Universal, fractional h.p., 110 volt, different makes
- *m)* Universal, variable speed, ½ h.p.

PLATFORM SCALE — 100 lb. capacity
- *c)* Malleable-iron C, 4, 6, and 8 in.

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a)* Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b)* Glue
- *c)* Stain, with metal-covered top
- *d)* Teacher's demonstration

BLACKBOARD — permanent or portable

BOOKCASE

BULLETIN BOARD

CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.

CHAIRS — teacher's and tablet arm

CORE OVEN — for patternmaking class

DESK — teacher's, with drawer compartments

FURNACE — for melting soft metals (for patternmaking class)

GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat

GLUE WARMER OR COOKER — 1- to 5-gal. capacity

GRINDER
- *a)* Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b)* Bench, hand or power
- *c)* Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d)* Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a)* 6-in. or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, equipped with safety guard.
- *b)* 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard.

LATHES
- *a)* 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block.
- *b)* Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a)* Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod.
- *b)* Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible.

SANDER
- *a)* Belt, direct motor drive
- *b)* Disk, motor or belt driven
- *c)* Oscillating spindle, motor driven
- *d)* Portable, hand-plane type, direct motor drive
- *e)* Vertical spindle and disk sander

SAWS
- *a)* Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b)* Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded.
- *c)* Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d)* Filing machine, direct motor drive
- *e)* Jig, direct motor or belt driven
- *f)* Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g)* Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h)* Universal saw bench, 14 to 16 in., motor driven
- *j)* Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with a ripping fence and miter cutoff gauges

SHAPER
- *a)* Motor drive, single or double spindle. Table to be equipped with removable center plate.
- *b)* Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw

VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.

WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class.

Woodworking — Small Tools

AWLS — brad, assorted sizes

BEVELS
- *a)* Protractor
- *b)* Sliding T, 8 in.

BITS
- *a)* Auger, 3/16 in. to 1 in., inclusive, by 16ths
- *b)* Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c)* Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d)* Countersink, for wood, rose pattern, ½ in. and 5/8 in.
- *e)* Dowel, square shank, ¼ in., 5/16 in., 3/8 in., ½ in., ¾ in.
- *f)* Expansive, 7/8 in. to 1½ in.
- *g)* Expansive, 7/8 in. to 3 in.
- *h)* Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j)* Screw driver square shank, ¼ in., 5/16 in., 3/8 in.
- *k)* Twist drill for wood, square shank, 1/16 in. to 3/8 in. inclusive, by 16ths
- *l)* Twist drill, straight shank, 1/16 in. to 3/8 in., inclusive, by 32nds

BLOWTORCH

BROOMS

BRUSHES
- *a)* Bench duster, 10 in.
- *b)* Floor
- *c)* Glue, round, 1½ in. and ¾ in.
- *d)* Glue, round, 1½ in.
- *e)* Marking, camel's hair, No. 1 and No. 2
- *f)* Varnish, flowing, 2 in. and 2½ in.
- *g)* Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round

CAN OPENER

CARVING TOOLS
- *a)* Sets containing 6 tools
- *b)* Sets containing 12 tools

CHISELS
- *a)* Cold, machinists', 3/8 in. and ½ in.
- *b)* Mortising chisel and bits, ¼ in. to 5/8 in. by 16ths
- *c)* Socket firmer, bevel edge, 1/8 in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d)* Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e)* Tanged firmer, bevel edge, 1/8, ¼, ½, ¾, 1, and 1¼ in.

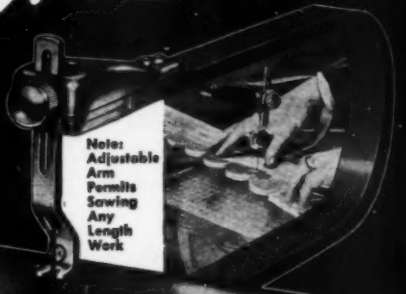
CLAMPS
- *a)* Bar, 24, 36, 48, and 60 in.
- *b)* Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.

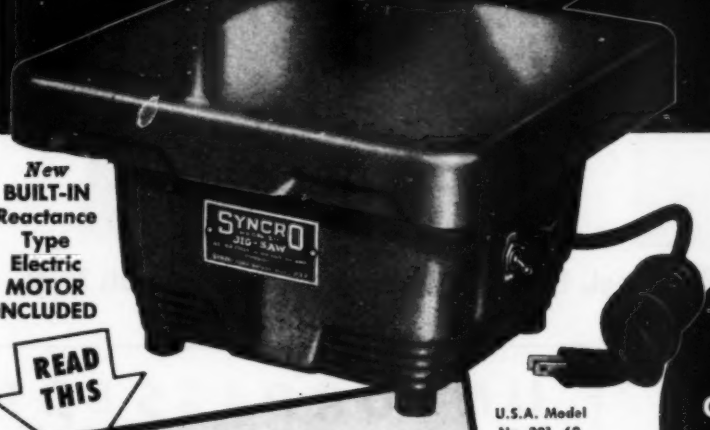
(Continued on page 57A)

Announcing

the SAFE, NEW

SYNCRO ELECTRIC JIG SAW





New **BUILT-IN Reactance Type Electric MOTOR INCLUDED**

READ THIS

DETROIT UNIVERSITY SCHOOL and
GROSSE POINTE COUNTRY DAY SCHOOL

April 23, 1951

Syncro Corporation
Oxford, Michigan

Gentlemen:

The Detroit University School uses the Syncro Saw in its elementary courses, particularly with younger boys, for it lends itself readily to their projects.

The safety with which it can be used, and the portability of it makes Syncro one of the most useful machines in our shop.

I, as teacher and director of the Mechanical Arts Department, would recommend the Syncro Saw as a necessary piece of equipment in any school shop.

Yours truly,

Samuel C. Beeler
Director of
Mechanical Arts

U.S.A. Model No. 201, 60 Cycle, 110-120 Volt AC. Other cycles, voltages available.

For Schools!

Ideal for **BEGINNING and INTERMEDIATE GROUPS because of its unique** *Safety* **Factor...Perfect for ADVANCED GROUPS!**

SYNCRO POWER UNITS GUARANTEED AGAINST BURN-OUT DURING YOUR OWNERSHIP OR REPLACED FREE!

CUTS 1" WOOD THIN METAL, PLASTIC...VERY QUIET!

SYNCRO proudly presents to the school world a new and better electric jig saw! SAFE for even FIRST GRADERS . . . all grades above — therefore PERFECT for instruction in MANUAL ARTS AND CRAFTS. Thousands of earlier Syncro Saws sold to schools, hospitals, institutions, homeshops. NOW — new "201" SYNCRO has 70% MORE power, cuts one inch wood, thin metal, plastics — operates VERY QUIETLY SAFE . . . because blade does NOT pull fingers towards it. Not a conventional "Lumber cutter" but for fine, delicate craftsmanship. Perfect for making models, toys, what-nots, etc. COMPLETE with new BUILT-IN Reactance Type Electric Motor. Mail coupon or write now for complete information and price.

SEND FOR FREE CIRCULAR!

SYNCRO, INCORPORATED
DEPT. VA-32, OXFORD, MICHIGAN, U.S.A.

☐ **Send me Free Circular describing No. 201 SYNCRO SAW and new No. 504 SYNCRO SANDER.**

NAME.....

STREET & NO.....

CITY.....ZONE....STATE.....

GRADE.....SCHOOL.....POSITION.....

SYNCRO, INC.
DEPT. VA-32 OXFORD, MICHIGAN, U.S.A.

WORLD'S LARGEST MAKERS OF ELECTRIC JIG SAWS

PARKS No. 20
20" PLANER

Here is a modernly designed, rugged, high-speed, low-priced planer that is ideally suited for every shop and industrial plant requiring a quality surfacer. The Parks No. 20 Planer has a four-knife cutterhead with a speed of 3600 R.P.M. and offers two feed speeds — 20 and 40 F.P.M., and 40 and 80 F.P.M. Write for complete descriptive literature.

The PARKS Heavy-Duty 12" x 4" Planer

A compact, sturdy, thickness planer that offers mill planer precision and ruggedness at a sensationally low price. Write for descriptive catalog sheet.

The PARKS WOODWORKING MACHINE CO., Dept. 22-A13 1546 Knowlton St., Cincinnati 23, O.

For Industrial Arts and Vocational Training

. . . are designed and constructed to give maximum utility and long service under hard usage.

. . . include single, double, and four-position work benches, utility and stake benches.

. . . are pictured and described in a new Catalog Sheet, entitled "Sjöström Work Benches".

If you're planning to purchase such equipment, it will pay you to send for this catalog sheet to the address below.

JOHN E. SJÖSTRÖM COMPANY

1712 N. Tenth Street, Philadelphia 22, Penna.

UNSURPASSED!
INDIVIDUALLY POWER-TESTED FOR BETTER PERFORMANCE

IMPROVED SPRING CLAMP
In three convenient sizes

"C" CLAMPS
Malleable and Steel
Openings ¾ in. to 18 in.

HAND SCREW
All popular sizes

QUICK CLAMPS
12 Patterns
Openings 4 in. to 5 ft.

STEEL BAR CLAMPS
10 Patterns
Openings 1 ft. to 12 ft.

Top-flight industrial arts and vocational schools depend on Hargrave Clamps . . . used and approved by industry for 71 years. Tough, flaw-free construction withstands rough handling by trainees. Fast and easy application. All parts subjected to rigid production tests . . . and accurately fitted by skilled craftsmen. Made in openings from ¾ in. to 12 ft., from ½ in. to 16 in. deep.

Write today for free catalog showing the complete line of Hargrave Individually Tested Clamps, Chisels, Punches, Brace Wrenches, Star Drills, Carbide Tipped Masonry Drills, Washer Cutters, File Cleaners, and Saw Vises.

THE CINCINNATI TOOL COMPANY

WAVERLY & MAIN AVES.
CINCINNATI 12, OHIO

(Continued from page 54A)

DIVIDERS — wing, 6 in. and 10 in.
DOWEL PLATE — 6 in. long.
DOWELING JIGS — with bushings
DRAWKNIVES — 7 in.
DRILL
- a) Automatic hand, with 8 drill points
- b) Chuck, 0 to 3/8 in.
- c) Hand, 0 to 3/8 in., for round-shank drills
- d) Star, for concrete, 1/2 in. and 3/4 in.

FILES
- a) Auger bit, assorted, 6 in.
- b) Cabinet, 8 in. and 10 in.
- c) Card and brush
- d) Flat, wood, 10 in.
- e) Mill, bastard cut, 12 in.
- f) Round, bastard cut, 12 in.
- g) Taper, slim, 5 1/2 in. and 7 in.

FIRST-AID CABINET AND SUPPLIES
GAUGES
- a) Bit, adjustable
- b) Jointer
- c) Marking, metal or hardwood
- d) Mortise, metal or hardwood
- e) Panel

GLASS CUTTER
GOUGES
- a) Tanged firmer, outside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- b) Tanged firmer, inside ground, handled, 1/8, 1/4, 1/2, 3/4, and 1 in.
- c) Spoon, 1/2, 3/4, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.
HATCHET — bench, 4-in. cut.
JARS — earthenware, 1-qt. capacity
KNIVES
- a) Jointer, to fit power machine
- b) Planer, to fit power machine
- c) Sloyd, 3-in. blade

LEVELS
- a) Wood, 24 in.
- b) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head
NAIL SETS — 1/16 in. and 3/32 in. points
OILERS — bench, 1/2 pt., coppered, best grade
OILSTONES
- a) 1 by 2 by 8 in. in iron box
- b) Gouge slip, medium, 4 1/2 by 2 1/8 by 5/8 by 5/16 in.
- c) Gouge slip, fine, 3 by 2 by 3/4 by 3/8 in.

PINCERS — 6 in. carpenters'
PINCH DOGS — 3/4, 1, and 1 1/4 in.
PLANES
- a) Block, adjustable, 6 in. long, 1 5/8-in. cutter
- b) Circular
- c) Combination, adjustable
- d) Core box
- e) Duplex, fillister and rabbet
- f) Fore, 1/8 in., 2 3/8-in. cutter
- g) Irons, double
- h) Jack, 14 in., 2-in. cutter
- j) Jointer, 24 in.
- k) Round, wood, 1 3/4 in.
- l) Router
- m) Smooth, 9 in., 1 3/4-in. or 2-in. cutter

PLIERS
- a) Roundnose, 5 in.
- b) Side-cutting, 6 in.

PUTTY KNIVES
RASPS — half round, wood, 10 in.
RULES
- a) Board
- b) 1 ft. or 2 ft. graduated by 8ths and 16ths
- c) Shrink, 1/8 in., 3/16 in.

SAWS
- a) Back, 12 in., 14 point
- b) Band, to fit power machine
- c) Compass, 10 in.
- d) Coping, frames
- e) Coping, blades
- f) Crosscut, 9 tooth, 22 in. long
- g) Crosscut, circular for power machine
- h) Dado, 1/8 in. to 1 1/16 in. to fit power-saw arbor
- j) Hack, frames, 10 in. or adjustable
- k) Hack, blades, 10 in.
- l) Keyhole, 10 in., 10 point
- m) Rip, 7 point, 22 in. long
- n) Rip, circular for power machine
- o) Set, 10 points per inch and finer
- p) Set, 10 points per inch and coarser
- q) Turning frame, 14 in.
- r) Turning blades, 3/16 by 12 in., 10 tooth
- s) Miter box, 24 by 4 in. saw, 7 in. capacity at miter

SCRAPERS
- a) Cabinet
- b) Glue, triangular
- c) Veneer, blade, 2 3/4 in. long, handle 11 in. long

SCREW DRIVERS
- a) Cabinetmakers', 4, 6, and 8 in.
- b) Quick return, spiral ratchet

SHOOT BOARD — and plane
SNIPS — tinners', forged steel, 2 1/2-in. cut
SPOKESHAVES — adjustable, raised handle, 10 in. long
SQUARES
- a) Combination, 12 in.
- b) Try, iron handle, 8 in.
- c) Framing, 2 ft.

STEEL FIGURES — hand cut, 1/8 in.
TAPELINE — 50 ft., steel
TRAMMEL POINTS — adjustable metal frame, steel points
TURNING TOOLS
- a) Calipers, 6 in. inside and outside
- b) Calipers, 12 in. inside and outside
- c) Parting tools, 1/8 in.
- d) Round point, 1/4 in., 1/2 in., 3/4 in.
- e) Spear point, 1/4 in., 1/2 in., 3/4 in.
- f) Square point, 1/4 in., 1/2 in., 3/4 in.
- g) Turning chisels, 1/4 in., 1/2 in., 3/4 in.
- h) Turning gouges, 1/4 in., 1/2 in., 3/4 in.
- j) Turning skews, L.H., 1/4 in., 1/2 in., 3/4 in.
- k) Turning skews, R.H., 1/4 in., 1/2 in.

VISE — 3-in. jaw, anvil face
WRENCHES
- a) Adjustable, 8, 10, and 12 in.
- b) Headless setscrew
- c) Pipe, 10 in. and 12 in.
- d) S type or open-end type to fit 1/8-in. to 1-in. N.C. nuts

(Continued on page 58A)

CHISELS, GOUGES, TURNING TOOLS

Tough, lasting fine cutting edges for all types of woodworking. Various types of socket butt and firmer chisels with "Hardwear" green plastic or hickory handles. Outside or inside bevel socket gouges. Short and full length turning tools.

AUGER BITS, CAR BITS AND DRILLS

There's a GREENLEE for every need . . . all types of twists and heads. Accurately sized, perfect cutting edges. Line includes the famous "Greenlee 22" Solid-Center Auger Bits which come to you "Plastic Sealed" for factory-sharp edges.

EXPANSIVE BITS

Fast, easy-boring Expansive Bits with free, positive chip clearance. Specially-designed wide, open throat assures smooth, uninterrupted action. In two styles — Setfast with quick adjusting-locking feature and Plain.

SPIRAL SCREWDRIVERS AND AUTOMATIC PUSH DRILLS

GREENLEE Spiral Screw Drivers are sturdily constructed and have special phosphor bronze drive nuts for long, hard service. Beautifully finished, three sizes. Automatic Push Drills have completely enclosed working parts and phosphor bronze drive nuts. Handle holds eight points. Chromium plated.

The GREENLEE line also includes Bit Extensions, Razor-Blade Draw Knives, Ship Augers, Electricians' Bits, Hand Benders for Tubing, Radio Chassis Punches, Knockout Tools and many other timesaving tools for the shop worker and the student.

TOOLS FOR CRAFTSMEN
GREENLEE

Free Folder H-301 with complete data on GREENLEE hand tools for the woodworker. Write Greenlee Tool Co., Division of Greenlee Bros. & Co. 2023 Twelfth Street, Rockford, Illinois. U. S. A.

Woodworking — Materials and Supplies

ALCOHOL

BENZINE

BRADS — 3/8 in., 1/2 in., and 5/8 in. No. 20; 3/4 in. and 7/8 in. No. 19; 1 in. No. 18; 1 1/4 in. and 1 1/2 in. No. 16; 1 3/4 in. No. 15; 2-in. and 2 1/2 in. No. 14

CARBON PAPER — black

COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion

COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion

DECALCOMANIA TRANSFERS

DOWEL PINS AND PLATES

DOWELS: hardwood, 3-ft. lengths, 1/4 in., 5/16 in., 3/8 in., 1/2 in., 3/4 in.

ENAMEL
- *a*) Selected colors
- *b*) Undercoater

FILLERS — paste: natural, golden oak, dark oak, and mahogany

FILLETS — leather, 1/4 in. and 1/2 in.

GLUE
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

HOOKS
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow

LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths

MOLDINGS

NAILS
- *a*) Common, 6d, 8d, and 10d
- *b*) Flathead, 1/2 in. No. 20, 3/4 in. No. 19, 1 in. No. 18, 1 1/4 in. and 1 1/2 in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

OIL
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

OVERLAY CARVINGS

PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply

PATTERN LETTERS

PINS — escutcheon

PUMICE STONE — No. 0

RAPPING PLATES

ROTTENSTONE

SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, 1/2, 1
Garnet finishing paper, 6/0, 4/0
Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order

SCREW EYES

SCREWS
- *a*) Flathead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 5 by 5/8 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in.
- *b*) Flathead, bright, No. 3 by 1/2 in., No. 4 by 1/2 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1 1/4 in., No. 10 by 1 1/4 in., No. 14 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in., No. 10 by 1 3/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2 1/4 in., No. 14 by 2 1/4 in., No. 14 by 2 1/2 in.
- *c*) Oval head, brass, No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., and No. 10 by 1 1/4 in.
- *d*) Roundhead, blued, No. 3 by 3/8 in., No. 3 by 1/2 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in.
- *e*) Roundhead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 4 by 5/8 in., No. 5 by 3/4 in.

SHELLAC
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

NOTE: Shellac should be kept in glass or earthenware containers

STAINS — oil, spirit, or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut

STEEL WOOL — No. 0 and No. 2/0

TURPENTINE

TWINE

VARNISH — coach, flat, remover, spar, and rubbing

WASTE — cotton, white

WAX — bees and finishing

WHITE LEAD

Wallace No. 11
Universal Saw
Spindle raises, lowers, tilts — table remains level on all cuts. Trouble-free direct-drive motor gives more power transmission. Motors up to 3 H.P.— up to 4" depth capacity, 48" rip.

Buy the Best — Buy Wallace!

The best is the cheapest — so for true, long-range economy, buy Wallace woodworking machines.

These machines are engineered for better work. They are built of better materials — they perform better, last longer, are easiest on your annual budget.

Illustrated are four units from our complete line of tools for the modern school shop. Write to us TODAY for bulletins and prices on the products you need.

Wallace No. 10
8" Jointer
Four-knived — with knives at an angle to give a shearing cut! Direct or gear drive for 20,800 cuts per minute. Variety of table sizes to give up to 6'4" overall length!

Wallace No. 16
16" Bandsaw
For faster, smoother cutting — with minimum blade breakage. Balanced wheels and smooth direct drive transmission eliminate vibration. Optional wheel speeds. Built-in light. Motors to 2 H.P.

Wallace No. 9
Mortiser
The same machine used in hundreds of cabinet shops and mills — a husky machine with chisel capacity from 1/4" to 3/4" selling in a moderate price range.

J. D. WALLACE & CO. 140 S. California Ave. Chicago 12, Ill.

TEACHERS EVERYWHERE

NOW USE THIS GENUINE HIDE GLUE

NO MIXING
NO HEATING
NO CHILLED JOINTS
NO ODOR

AVAILABLE IN 6 SIZES
TUBE, QUARTER-PINT, HALF-PINT, PINT, QUART AND GALLON

HIDE GLUE AT ITS BEST

Exactly like the fine old hot hide glue you know is best for all woodwork—yet it is ready to use right out of the can. No waste because of over-mixing or spoilage. Ready when classes start. Foolproof for beginners.

WILL NOT DULL TOOLS

Franklin hide glue never gets hard or brittle. It is resilient and tough like raw hide. It is easy to use and easy on tools.

DOES NOT STAIN WOOD

MAKES JOINTS STRONGER THAN THE WOOD ITSELF

Tests prove more than 4000-pounds-per-square-inch strength. Stronger than any wood.

HAVE YOU MADE THIS TEST?

1. Squeeze a little Franklin Glue on a piece of glass or clean wood. Squeeze out the same amount of any other liquid glue beside it.

2. Let set overnight, then compare the two. Leave for two or three days and note the difference.

FREE

Samples sent when request is made on official school letterhead

The Franklin Glue Co.
129 W. Chestnut St.
Columbus 15, Ohio

THE CHOICE OF FINE CRAFTSMEN EVERYWHE
USED BY MANUFACTURERS OF QUALITY FURNIT

ELECTRICAL SHOP

(Continued from page 52A)

Communication — Our Modern Tom-Toms

The beat of jungle drums in the night holds a weird fascination and mystery. We, of course, don't hear such things in this country, but in certain jungle and Pacific island tribes, the natives still use drums as a primitive "jungle telegraph," and are able to send messages over quite some distance.

We have used a modern electrical tom-tom for the past one hundred years. It is silent as electricity speeds through the wires, but in depots and telegraph offices there is the steady clicking of our version of the telegraph.

We are all familiar with the telegraph, but let's go back and see how man gradually developed our modern message system.

The messenger on foot or mounted was one of the most dependable methods of sending words in ancient times, but at best this system was slow.

Man, the impatient, wanted more speed. At first, signal fires were used. Records show that the ancient Greeks used beacon fires three thousand years ago. In fact, it is from them that we get our word "telegraph," which means "to write at a distance."

Flashing reflected sunlight from a mirror has been used for centuries as a means of communication. You can easily learn to "heliograph" (write with light) messages to members of your neighborhood gang. A mirror and the Morse code are all you need besides a bright sunny day.

Our American Indian used fires and smoke puffs in a primitive attempt to send his words to others. Sometimes he built several fires, and let the columns of smoke rise into the air. The number of smoke columns was the signal. Or he would just build one fire and throw on green leaves to make it smoke, then cover the fire with a blanket. By lifting the blanket he would release puffs of smoke and make a code signal visible to distant watchers.

In France, a system of towers was constructed which held two movable arms high on a pole. The position of the arms could be changed to represent different letters. These towers, about ten miles apart, managed to relay messages at the rate of 100 words an hour.

This semaphore, as the system was called, was a step in man's search for a speedy way to send messages. Using flags held in the hands, navy men and boy scouts still use the semaphore system today. Compared to modern teletype sending thousands of words an hour, semaphore does seem very slow and clumsy!

Then, about two hundred years ago, Benjamin Franklin transmitted electricity several hundred feet through a wire. A hundred years later, Henry, a college professor, sent current nearly a mile to make an electromagnet ring a bell at the other end of a wire.

A famous artist heard of these experiments and became so interested that he quit painting and developed the electric telegraph. His system is now used today, with improved equipment. In honor of this inventor, the *Morse* telegraph code carries his name. It is the code used by land telegraphy in the United States. A few changes were made to form the International Code used by radio and the rest of the world.

(Continued on page 63A)

Looking for an Art Department BUDGET-STRETCHER?

Hamilton has the answer!

Hamilton Student Table V-1704

What's so sensational about the V-1704? Not a thing! It's just a mighty fine student drawing table available at a surprisingly modest price. Solidly built of Northern Wisconsin Birch throughout, and attractively finished in Golden Brown, the V-1704 offers easy, fool-proof top adjustment without clumsy protruding levers. Both tilting and stationary tops are generous work-size, and tilting top is equipped with an adjustable paper ledge. Stationary top furnishes generous reference surface for colors, etc.

There's a *built-in bonus* of quality in all Hamilton school equipment—the result of Hamilton's unmatched experience and manufacturing facilities. So whether you're buying a single table or completely equipping a new art room, find out more about the Hamilton V-1704 student drawing table. A similar table 36" long x 24" wide by 30" is listed as No. V-1703. Write for full details and prices today.

	LENGTH	WIDTH	HEIGHT	DEPTH
Overall	34"	20"	30"	
Drawer	14½"	9"		2⅛"
Adjustable Top	24"	20"		
Stationary Top	10"	20"		

Hamilton

MANUFACTURING COMPANY
Two Rivers, Wisconsin

TEST ON WOODS AND THEIR USES

AMOS G. WILLIAMS
Southeast Missouri State College
Industrial Arts Department
Cape Girardeau, Mo.

Commercial Woods and Their Uses

Many domestic and imported woods are commercially significant. Some of them have specialized importance; others are in demand for a variety of uses in this country. The student will be tested on his knowledge of their uses in the woodworking and manufacturing industries:

1. applewood
2. aspen
3. balsa
4. bamboo
5. basswood (linden)
6. beech
7. birch
8. black cherry (Appalachian)
9. black walnut (American)
10. boxwood
11. butternut (white walnut)
12. cane
13. chestnut
14. Circassian walnut (persian)
15. coco bola
16. cottonwood
17. dogwood
18. ebony
19. elm
20. fir (Douglas)
21. hackberry
22. hemlock
23. hickory
24. holly
25. larch
26. lemonwood
27. lignum vitae
28. lodgepole pine
29. locust (black)
30. longleaf yellow pine (Georgia)
31. magnolia
32. mahogany (African)
33. mahogany (Honduras)
34. mahogany (Philippine)
35. Mediterranean briar
36. northern white pine
37. Norway, Sitka spruce
38. orangewood
39. osage orange
40. pernambuco (Brazil wood)
41. persimmon
42. ponderosa pine
43. Port Orford cedar
44. red alder
45. red cedar (Tenn., eastern)
46. red gum (sweet)
47. red oak
48. red spruce (eastern)
49. redwood
50. rosewood
51. sandalwood
52. satinwood
53. shortleaf pine (hard, yellow)
54. southern cypress (bald)
55. sugar maple
56. sugar pine
57. sycamore
58. tamarack
59. teak
60. tulipwood
61. tupelo gum (bay poplar)
62. walnut burl
63. western cedar
64. western white pine (Idaho)
65. western yew
66. white ash
67. white cedar
68. white oak
69. willow
70. yellow poplar

SUGGESTED REFERENCES

1. Douglass, J. H., and Robert, R. H., *Instruction and Information Units for Hand Woodworking*, McCormick-Mathers Pub. Co.
2. Fryklund, Verne C., and LaBerge, Armand J., *General Shop Woodworking*, McKnight & McKnight, publishers.
3. Fryklund, Verne C., and Sechrest, Charles H., *Materials of Construction*, The Bruce Publishing Co.
4. Groneman, Chris H., and Williams, E. L., *Exploring the Industries*, The Steck Co.
5. Kellog, R. S., *Lumber and Its Uses*, Scientific Book Corp.
6. Knight, E. Vernon, and Wulpi, Meinrad, *Veneers and Plywood*, The Ronald Press.
7. Koehler, Arthur, *The Properties and Uses of Wood*, McGraw-Hill Book Co.
8. Newell, Adnah C., *Wood and Lumber*, The Manual Arts Press.
9. Noble, L. H., and Everill, R. B., *From Forest to Woodworker*, The Bruce Publishing Co.
10. Noyes, William, *Wood and Forest*, The Manual Arts Press.
11. Tustison, Francis E., *Forests, Trees, and Wood*, The Manual Arts Press.
12. U. S. Department of Agriculture, Forest Products Laboratory, *Wood Handbook*, Superintendent of Documents, Washington, D. C.

(Continued on next page)

Paxton Lumber
in your school shop means

A complete line of Hardwood and Softwood Lumber and Plywood

AMONG OUR OTHER ITEMS:

Ball Bat Blanks — Sample Sets
Formica — Closet Linings
Furniture Squares — Table Legs
Glues — Dowels
Walnut-Cedar Chest Sets

— Sturdy, attractive projects
— First quality materials
— Carefully graded pieces
— Greater economy
— Happier craftsmen

Order the woodworking handbook, BEAUTIFUL WOODS. Only $1.00.

FRANK PAXTON LUMBER CO.
Specialists in Industrial Arts Lumber and Plywood for Over Thirty Years.
OFFICES AND YARDS AT:
Chicago, Illinois — 5701 W. 66th Street
Denver, Colorado — P.O. Box 1676 — Des Moines, Iowa — P.O. Box 683
Fort Worth, Texas — P.O. Box 1225 — Kansas City, Missouri — 1004 Baltimore
Write to yard nearest you for Price list and Stock sheet.

(Continued from previous page)

13. U. S. Department of Commerce, *American Hardwoods and Their Uses*, Superintendent of Documents, Washington, D. C.
14. Waring, Ralph G., *Wood Finishing Made Easy*, The Bruce Publishing Co.

Commercial Woods and Their Uses

Procedure: For each item of the right column there is a matching item in the left column. Place the paired letter in the parenthesis.

(A) hammer handles, wagon spokes	( ) 1. hard maple
(B) white inlay, marquetry	( ) 2. balsa
(C) window sash & frames, millwork	( ) 3. holly
(D) railroad ties, cooperage	( ) 4. red cedar (Tenn.)
(E) water tanks, siding, shingles	( ) 5. western cedar
(F) model airplanes	( ) 6. hickory
(G) ballroom floors, croquet mallets	( ) 7. dogwood
(H) art metal mallets	( ) 8. white pine
(I) mothproof chests, lead pencils	( ) 9. chestnut
(J) telephone poles, electric poles	( ) 10. redwood
(A) ideal American cabinet wood	( ) 11. applewood
(B) liquor kegs, church furniture	( ) 12. cypress
(C) rules and scales	( ) 13. Port Orford cedar
(D) water tanks, coffins	( ) 14. boxwood
(E) child's lightweight ball bat	( ) 15. yellow pine
(F) arrows (archery), Venetian blinds	( ) 16. locust
(G) saw handles, smokers' pipes	( ) 17. willow
(H) inlay, marquetry, veneers	( ) 18. black walnut
(I) building construction, framing	( ) 19. white oak
(J) crating and boxes	( ) 20. tulipwood
(A) plywood core stock	( ) 21. lignum vitae
(B) highly figured veneers	( ) 22. coco bola
(C) dowels, spools, toothpicks	( ) 23. pernambuco (Brazil)
(D) casting rods, sunporch furniture	( ) 24. mahogany (Philip.)
(E) violin bows	( ) 25. birch
(F) knife handles	( ) 26. cane
(G) woven furniture seats	( ) 27. walnut burl
(H) bowling balls	( ) 28. bamboo
(I) marine plywood	( ) 29. basswood
(J) excelsior, paper pulp	( ) 30. yellow poplar
(A) baseball bats	( ) 31. lemonwood
(B) wagon tongues, implement members	( ) 32. rosewood
(C) black piano keys, piccolos	( ) 33. bone-rubbed ash
(D) tavern bars, rathskellers	( ) 34. Honduras mahogany
(E) knife handles	( ) 35. Circassian walnut
(F) American colonial furniture	( ) 36. teak (Asiatic)
(G) ship's timber, decking	( ) 37. red oak
(H) custom made gun stocks	( ) 38. ebony
(I) inexpensive doors, plywood	( ) 39. Appalachian cherry
(J) bows (archery)	( ) 40. fir
(A) foundry patterns	( ) 41. ash
(B) golf clubs (driver heads)	( ) 42. spruce
(C) woodenware (salad bowls)	( ) 43. hard pine (longleaf)
(D) shovel and hoe handles, skis	( ) 44. Mediterranean briar
(E) concrete form work	( ) 45. western yew
(F) musical sounding boards (piano)	( ) 46. sugar maple
(G) smokers' pipes (tobacco)	( ) 47. persimmon
(H) canoe paddles, bows (archery)	( ) 48. white cedar
(I) picture frames, cooperage, plywood	( ) 49. white pine
(J) shingles, fence posts	( ) 50. red gum

KEY TO TEST — WOODS AND THEIR USES

1. G	6. A	11. G	16. J	21. H	26. G	31. J	36. G	41. D	46. C
2. F	7. H	12. D	17. E	22. F	27. B	32. E	37. B	42. F	47. B
3. B	8. C	13. F	18. A	23. E	28. D	33. A	38. C	43. E	48. J
4. I	9. D	14. C	19. B	24. I	29. J	34. D	39. F	44. G	49. A
5. J	10. E	15. I	20. H	25. C	30. A	35. H	40. I	45. H	50. I

ARMSTRONG

DROP FORGED TOOLS

Improved designs, with bodies of special open hearth steel, heat treated to extreme stiffness and toughness . . . these tools are internationally recognized as unsurpassed in quality.

ARMSTRONG C Clamps. Heavy, Medium, Extra Deep Throat, Splatter Resisting, Tool Makers and Machinists Clamps.

ARMSTRONG Lathe and Milling Machine Dogs. 11 types all sizes.

ARMSTRONG Eye Bolts — 4 types, sizes from ¼" to 2½"" I.D.

Also Drop Forged, Hoist Hooks and Machine Handles.

Write for Catalog.

ARMSTRONG BROS. TOOL COMPANY
5222 West Armstrong Avenue
Chicago 30, Illinois, U. S. A.

DREMEL

14,400 SANDING STROKES PER MINUTE

MODEL 2000 with steel storage case, 25 abrasive sheets, sheepskin pad — $24.50

(PATENTED)

MODEL "A" with 6 sandpapers, 1 sheepskin, 1 felt pad — $14.85

DREMEL STRAIGHT-LINE ACTION SANDERS GUARANTEE FLAWLESS, SCRATCH-FREE FINISHES

● Both of these Dremel *straight-line* action sanders are ruggedly constructed — ideal for student use — Model 2000 for any type woodworking assignment, including desk refinishing, general school maintenance — Model "A" for lighter projects. Each model has only 2 moving parts — requires no oiling or attention — uses 110-120 V., 60 cycle A.C. Model 2000 has 21 sq. in. sanding surface, weighs 5 lbs. Model "A" has 12 sq. in. sanding surface, weighs 2½ lbs. *Both are excellent polishers.* Dremel Sanders are precision tools widely used in schools, home workshops, and industry. Fully guaranteed. *If your dealer can't supply, order direct. Write for complete tool catalog.*

DREMEL MANUFACTURING CO. Dept. 312-C RACINE, WIS.

ELECTRICAL SHOP

(Continued from page 60A)

Sending by hand, a good operator can handle 50 words a minute (250 letters). Automatic senders like the teletype can transmit as high as 350 words a minute (1750 letters). Since it is now possible to send 30 messages at the same time over one wire, fewer wires are needed to carry the "traffic," as the messages are called. This means less cost for wire, and lower rates when *you* send a telegram.

One hundred years ago, two ships met in mid-Atlantic and spliced together the first cable to link continents. This cable from England to America was the first in the network that has since put the whole world at our doorstep.

Telegraph has made communication possible between men hundreds of miles apart. Man has at last cast off the chains which limited sending words with speed over great distances. Electricity, speeding through wires and controlled by man, has linked the countries on earth into one world.

Modern telegraphy certainly beats beating a drum, and it is more fun too! A telegraph system between neighboring houses is simple to make. Get together with your friend next door and try it!

For additional reading:

"Telegraph," *Compton's Pictured Encyclopedia and Fact-Index*, Vol. 14, 1948, p. 80.

C. F. Kettering, "Dots and Dashes," *Short Stories of Science and Invention* (Detroit, Mich.: General Motors Corporation), pp. 64–65.

Electricity and the Human Body — Sudden Death

Electrocution is not a very nice word. It is about like saying "death," and that makes most people think seriously.

The word "electrocute" is the result of combining the first part of "electric" and the last part of "execute."

Sometimes electrocution is intentional, like inflicting death by passage of current through the body of a condemned criminal.

The first experiment with electrocution was about 60 years ago (March 2, 1889) when several dogs, four calves, and a horse were put to a painless death.

The state of New York was the first to use the method in place of hanging for inflicting the death penalty. The dubious honor of being the first human to be electrocuted fell to one William Kemmeler, alias John Hart, who was convicted of murder.

For the next three or four seconds, a 2000-volt current is passed through the body. This is followed by a minute of 500-volt pressure. The cycle is repeated two or three times to abolish reflexes in the body.

Gruesome business, isn't it?

But — accidental electrocution takes a far more heavy toll of American lives! Most of these accidents are from carelessness and misuse of electrical equipment in the home. If you use an electric appliance over a damp area, wear rubbers and stand on dry boards. In the bathroom or kitchen, always keep appliances out of reach of persons at a sink or in the bathtub.

Hope for life is not gone, however, if the victim has had but a brief contact with electricity. Cases of apparent death are brought about by brief contact with very high voltage such as trolley wires or high voltage in industry. In these cases the shock paralyzes the respiratory system before it stops the heart. Thus, in many cases, life may be restored if artificial respiration is started immediately!

However, any electric shock is serious business. It can be sudden death!

(Continued on next page)

BERKROY TOOLS FOR THORO SHEET METAL TRAINING

SHOP On-A-Bench

A complete 5-tool sheet metal shop in one compact unit. All tools handle sheet steel up to 20-gauge. All operate like larger, industrial shop tools.

TOOL STAND
Heavy gauge steel. 18" x 68" x 35".

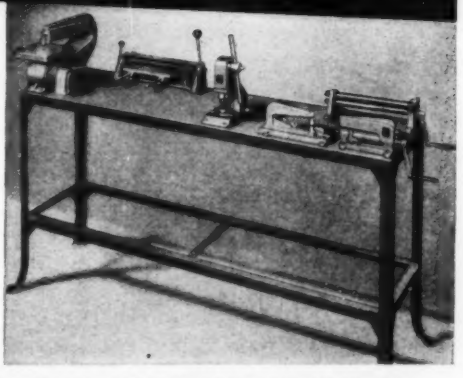
12" BRAKE
Bends sheets and makes simple metal trim.

NIBBLER-SLITTER
12" throat capacity. Cuts odd shapes. Does straight or scroll work.

SHEAR and CLAMPING HEAD ACCESSORY
For trimming, strip cutting, outside circle and contour cutting.

HAND PUNCH
For use with dies, punches and cutting blades for punching, press fits, notches, corner cuts, etc.

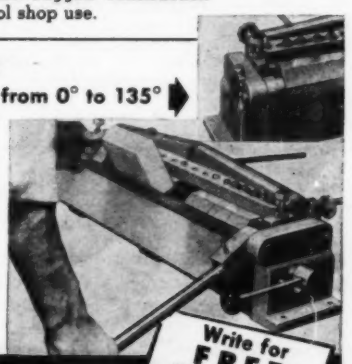
12" SLIP ROLL
Forms cylinders, reverse curves, scrolls, etc.



FOR LARGER WORK, WIDER VERSATILITY—24" RING AND CIRCLE SHEAR

The only tool of its type with the *Micro Feed Handle* for adjustment of circle diameters. Cuts rings and circles up to 24" diameter from square stock. Handles a wide variety of trimming operations, strip cutting and contour cutting on sheet metal up to 20 gauge. Cutters are hardened, tempered tool steel. 32" x 7" bed length, 12" x 4½" shear, and 21" x 3¾" clamping head assure capacity for a wide variety of projects, of industrial size. Accurately machined, enclosed gears and rugged construction assure sustained accuracy under constant school shop use.

BERKROY 24" BOX AND PAN BRAKE
With Positive stop at any angle from 0° to 135°



Makes intricate folds, reverse bends and radius bends on sheet steel up to 16 gauge and up to 24" wide. The accuracy, ease and speed of its operation result from features found in no other brake. Bending leaf operates on Torrington Needle Bearings. Full 1" clearance between top fingers and anvil. Maximum 2½" box or pan depth permits deeper bends. Turning a knob provides infinite adjustment to any angle from 0° to 135°. Forms any size box or pan from ½" to 24" by ¼" graduations.

For catalog information, write to

BERKROY PRODUCTS, Inc.

2512 N. ONTARIO STREET • BURBANK, CALIFORNIA

Write for FREE SCHOOL SHOP PATTERN PROJECT

Print-Shop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- *a*) Hand, small size
- *b*) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- *a*) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *i*) Type, complete with 24 full-size California job cases, double work bank, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.
- *l*) Storage for cuts

CANS
- *a*) Benzine, pint size
- *b*) Benzine, 5-gal. size
- *c*) Kerosene, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

CASES
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼ size, for ornamental borders
- *c*) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- *d*) Metal furniture, to hold laborsaving fonts
- *e*) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- *a*) For platen presses
- *b*) For cylinder presses

CHASES
- *a*) For each size of platen press
- *b*) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- *a*) Lead and rule
- *b*) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- *c*) Paper, lever type, 26 in. or 30 in.
- *d*) Paper, lever type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

DESK
- *a*) Bindery, 80 by 36 in.
- *b*) Drying rack
- *c*) Imposing, 51 by 39 in.
- *d*) Make-ready, 32 by 24 in.
- *e*) Paper cutters, 80 by 36 in.
- *f*) Proofreaders
- *g*) Teacher's

DRYING RACKS
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- *a*) 12 by 18 in., with iron top, including reglets and furniture
- *b*) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 by 63 in., with iron top, complete with drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- *a*) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- *b*) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- *a*) Overlay, for make ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

LEADER BOXES

LEADERS
- *a*) 6, 8, and 10 pt., fine dot
- *b*) 8 and 10 pt., hyphen

LINE GAUGES
- *a*) Metal, brass, or steel
- *b*) Wood

MALLET

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- *a*) For use on presses
- *b*) Hand machines

ORNAMENTS
- *a*) Assorted floral and decorative designs
- *b*) Border, 6 and 12 pt., decorative

PAPER-DRILLING MACHINE

PERFORATOR
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

PLANER
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple with leather top

PRESSES
- *a*) Cylinder, two revolution, four roller, 17 by 22, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 by 18, complete with variable-speed motor, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 by 18, with cabinet
- *f*) Proof, 20 by 24, with cabinet
- *g*) Proof, 23 by 24½, with cabinet
- *h*) Tableting

PUNCH
- *a*) Foot power, multiple with assorted punches
- *b*) Lever, two die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- *a*) 2 pt., laborsaving, hair line, side face
- *b*) 2 pt., laborsaving, 1 pt. side face
- *c*) 1 pt., laborsaving, 1 pt. face
- *d*) 2 pt., laborsaving, double face

SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SILK-SCREEN UNIT

SPACING MATERIAL
- *a*) Iron furniture, as selected
- *b*) Leads, laborsaving, 2 pt.
- *c*) Leads, 2-ft. strips, 2 pt.
- *d*) Slugs, laborsaving, 6 pt.
- *e*) Slugs, 2-ft. strips, 6 pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STEREOTYPING UNIT, 8 by 12 in.

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

TYPE
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt., 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *i*) Job, boldface Italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- *k*) Job, heavy copperplate Gothic

(Continued on page 66A)

ELECTRICAL SHOP

(Continued from previous page)

For additional reading:

"Electrocution," *Encyclopedia Britannica*, Vol. E (Chicago: Encyclopedia Britannica, Inc., 1941), p. 316.

"Electric Equipment," *Safety Education Data Sheet No. 9* (Chicago: National Safety Council).

W. J. Turrell, *The Principles of Electrotherapy* (London: Humphrey Milford, Oxford University Press, 1929), p. 202.

Electricity and the Human Body — Lucky You!

Yes, lucky you! As easy as it is to electrocute yourself, it is becoming less likely that it will be an accident. There are men who have devoted their lives to protecting you from yourself.

They are the scientists of the Underwriters' Laboratory (UL). The next time you walk through the dime store or a hardware store, see if you can find little yellow bands around electric wire on sale. See if you can find small yellow labels with the letters "UL" stamped on a fan or electric razor, or other electric equipment.

Better yet, see how many of the electric appliances in your home have the UL stamp of approval! It's life insurance, for the UL label means that the appliance meets rigid standards developed for your

(Continued on page 70A)

Put your print shop problems on our drawing board

Do you need a more efficient shop layout—new equipment—more teachers—more students? Whatever your problem, let ATF help you solve it.

Give us information on your graphic arts department and we'll make a layout, indicating the best location of equipment to provide maximum operating efficiency, correct lighting, pupil safety.

This is just part of ATF's specialized service for vocational and industrial arts schools. We shall also be glad to work with you in outlining training courses for your students or in helping you find competent instructors for your classes.

If you are interested in broadening the present scope of your department by installing new presses, the versatile Little Giant 6 for letterpress or ATF Chief 22 for offset are ideal—easy to operate—easy to handle for student instruction and learning. They're also tops in their size for printing and production.

Call on ATF whenever you need specialized engineering service or any print shop equipment. AMERICAN TYPE FOUNDERS, Department of Education, 200 Elmora Avenue, Elizabeth B, New Jersey.

ATF

BETTER PRINTING FROM THE WIDEST LINE OF PROCESSES

Type faces shown are: Spartan and Century Schoolbook

GRAVURE...LETTERPRESS...OFFSET

THE COMPASS THAT HAS MADE
VEMCO FAMOUS
Look for the Red Dots
No. C-110 6½" Bow Compass
VEMCO "open truss" design gives you the strongest, most accurate and most durable draftsman's compass obtainable.
With these instruments you can describe the finest pen line or the heaviest pencil drawing with absolute precision.
In addition VEMCO compasses give you greater capacity. The No. C-110 6½" compass, for example, gives you a range from ⅛ inch to 10 inches.
Irrespective of price, you cannot buy greater accuracy than the VEMCO. Ask your VEMCO dealer for a demonstration or write today for illustrated literature.
V. & E. MANUFACTURING CO.
Pasadena 20, California
ASK TO SEE THE COMPLETE VEMCO LINE
Drafting Machines
Drawing Sets
Compasses
Microliner Ruling Pens

USBLUCO

The Top Quality Line!

ONE DEPENDABLE SOURCE FOR ALL YOUR NEEDS

Drawing Instruments — Triangles
Drawing Boards — Slide Rules
T Squares — Drawing Paper

All The Materials and Instruments Required For Drafting, Drawing And The Industrial Arts

ALL ORDERS PROMPTLY FILLED!

Write Dept. A-3 Today For Illustrated Circular, Prices and FREE Samples Of Drawing Papers!

U. S. BLUE PRINT PAPER COMPANY
Since 1898 USBLUCO
205 S. WABASH AVE. CHICAGO 4, ILLINOIS

(Continued from page 64A)

— 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
l) Wood, condensed Gothic — 8, 12, 15, and 18 line
m) 10 pt. line leaders, 4 dots to the em
n) 10 pt. braces and dashes
o) 10 pt. fractions
p) 10 pt. references
q) Parentheses and brackets
r) 2 pt. laborsaving leads, 4 to 25 picas
s) 6 pt. laborsaving slugs, 4 to 25 picas
t) 2 pt. laborsaving brass rule
u) 2 pt. miters for rule
v) Laborsaving metal furniture
w) Thin spaces with quarter-size case

TYPESETTING MACHINES
a) Either linotype or intertype, 2 or 3 magazines, and molds
b) Matrices for same, 6, 8, 10, and 12 pt., as selected

VISUAL AID CHARTS

Print-Shop Supplies

BENZINE OR GASOLINE — for cleaning type or presses
BINDERY TAPE — 2 in. wide, brown or black
GOLD BRONZE — pale
INK
a) Bond, black, for bond papers
b) Book, black, for school papers, etc.
c) Cover, colors as selected
d) Dryers and compounds, as selected
e) Half tone, black
f) Job, colors as selected
g) Metallic, gold and silver
h) Process, black, red, yellow, blue

KEROSENE — for cleaning rollers
PADDING CEMENT
a) Cold
b) Hot

PAPER
a) Bond, fine grade, 17 by 22 — 20, white
b) Bond, medium grade, 17 by 22 — 20, white
c) Bond, sulphite, 17 by 22 — 20, white
d) Bond, sulphite, 17 by 22 — 20, colors as selected
e) Book, enamel, 25 by 38 — 80, white
f) Book, machine finish, 25 by 38 — 80, white
g) Book, eggshell finish, 25 by 38 — 60, white
h) Cover, as selected, 20 by 26, medium
i) Card Bristol, fine grade, 22 by 28 — 4 ply, white
k) Index Bristol, medium grade, 25½ by 30½ — 110, white
l) Index Bristol, medium grade, 25½ by 30½ — 140, white
m) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No 50
p) Tagboard, manila, 24 by 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

PASTE
a) Bindery
b) Make ready

SILK-SCREEN SUPPLIES consisting of:
a) Silk-screen process paste paint, 1 each of the following colors: toluidine red, strontian yellow, ultramarine blue, medium green, rich brown, orange, purple, white, and black
b) Solvent profilm in 11- by 14-in. sheets
c) 8-in. synthetic squeegee
d) 11-in. synthetic squeegee
e) No-clog varnish
f) Film solvent
g) Stencil filler
h) Filler remover
i) Stencil knife
k) Fiber guides
l) Red sable brush — ½ in.
m) Putty knife
n) Frame tape

TWINE — cotton, for tying jobs
WIRE STITCHING
a) No. 28 round wire for stitcher
b) Wire staples, ¼ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER
BEAM COMPASS
BENCH BRUSHES
BLACKBOARD
a) Permanent or portable
b) Compass, 15 in., with locking device
c) Drawing set: T square, straightedge, triangle, and protractor

BLUEPRINT
a) Frame or machine
b) Washing trays or washer
c) Paper tube, airtight
d) Drying rack or dryer

BOOKCASE
CABINET
a) For filing drawings

(Continued on page 69A)

Pittsburgh COLOR DYNAMICS contributes to

- Higher plant efficiency
- Greater safety
- Better housekeeping

● White Sewing Machine Corporation, of Cleveland, Ohio, uses COLOR DYNAMICS to improve production and employee relations.

Tomorrow's skilled shopmen must know how *energy in color* improves production techniques

THE knowledge of the skilled shopman of tomorrow will go beyond mere metals, machines and methods. He will also know how to use the *energy in color* to turn out more and better work.

● **That's why** many educators in the vocational and manual sciences now include Pittsburgh COLOR DYNAMICS in their training courses.

● **COLOR DYNAMICS** is a scientific painting method based upon the simple reaction of human beings to color. Tests have shown that some colors stimulate, others are restful, still others depress—even cause irritation and discomfort.

● ***Focal* colors** lessen eye fatigue and nervous tension. *Eye-rest* colors relax the eyes of the worker. *Morale-building* colors promote cheerfulness and restrain mental depression. *Safety* colors lessen accident hazards.

● **COLOR DYNAMICS** has been used with success in many thousands of plants throughout the country. It is now recognized as a distinct advance in production technique. If you wish your students to be equipped thoroughly for their future tasks, begin now to teach Pittsburgh COLOR DYNAMICS as part of your regular program.

● **For a practical demonstration** of the benefits of COLOR DYNAMICS, paint the walls, ceilings and machines of your manual training rooms and see the difference it makes.

● **Write today** for a free copy of our booklet on COLOR DYNAMICS which contains a full explanation of this painting system and how to use it.

FREE—Color Engineering Study of Your Classrooms

● **Should you desire** a color engineering study of your classrooms—we'll be glad to make one *free* and without obligation. There's a COLOR DYNAMICS expert at each of our offices in principal cities. A call will bring a representative at your convenience. Or send this coupon.

SEND FOR FREE COPY OF THIS BOOK!

Pittsburgh Plate Glass Co., Paint Div.
Department IA-32, Pittsburgh 22, Pa.

☐ Please send me a FREE copy of your new revised and enlarged booklet, "*Color Dynamics In Industry.*"

☐ Please have your representative call for a Color Dynamics Survey of our properties without obligation on our part.

Name _____

Street _____

City _____ County _____ State _____

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

Unmatched smoothness! "Electronic" is Eagle's trade name for a blend of purest crystalline graphites reduced to micronic fineness in our patented Attrition Mill. Leads made with it 100% have a frictionless, smooth-gliding quality never approached before.

Non-crumbling points! The microscopic graphite particles of infinitely varied, close-interlocking shapes combine with the clay binder to form the strongest, longest-wearing lead structure ever made.

Perfect reproduction! Because millions more of these finer graphite particles are compacted in every inch of its lead, Turquoise deposits denser, blacker, even lines that reproduce to perfection.

Precision grading! 17 individual, exactly controlled formulas of Electronic graphite and clay keep the 17 degrees of Turquoise evenly spaced and as true as a plumb line.

Free Sample: Write for a free sample, naming this magazine, your dealer, and the grade you desire.

*®

EAGLE PENCIL COMPANY • NEW YORK • LONDON • TORONTO

(Continued from page 66A)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
DRAFTSMAN'S STEEL PROTRACTOR
DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
DRAWING TABLES AND STOOLS
a) For students
b) For teachers
INK-BOTTLE HOLDER
IRREGULAR CURVES — Nos. 17, 21, and 24, wood, rubber, or transparent
LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30–60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK
To be provided by, or for, each student

Drafting — Small Equipment

DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30–60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting — Additional Supplies

To be provided by, or for, each student
ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE

NOW sets of
DRAWING INKS IN COLOR
suitable for ARTIST STUDENT or HOBBYIST
HIGGINS
"Systematic No. 18"
Complete assortment (18) ¾ oz. bottles in handsome gift box arranged according to Ostwald color wheel
.....$5.00 each
"Studio No. 8"
Eight ¾ oz. bottles in sturdy box. Contains Red, Yellow, Blue, Green, Red Violet, Turquoise, Brown and Black
.....$2.25 each
"Scholastic No. 4"
Eight ⅜ oz. bottles with translucent stoppers in gift box. Contains Red, Yellow, Blue, Green, Violet, Orange, Brown and Black
.....$1.25 each
Prices shown are U. S. A. unit retail prices.
ASK YOUR DEALER FOR THESE ASSORTMENTS
HIGGINS INK CO., INC.
271 NINTH ST., BROOKLYN 15, N.Y.

ELECTRICAL SHOP

(Continued from page 64A)

safety! The UL label on the cord is for the cord only. Look for another yellow UL on the appliance itself.

The Underwriters' Laboratories have a testing machine to twist and untwist electric heater cord like that found on your toaster or flat iron; if the cord withstands 10,000 twist-untwist operations without a short circuit, it is given the UL approval.

Consider an iron like that which presses your clothes. If it carries UL approval, it was browbeaten, dropped in all possible positions, and made to carry eight times as much voltage as it was designed to carry. Then if it still worked, it was tested to see that it didn't overheat.

It is said that one family went on vacation, leaving their iron turned on. The iron charred its way through the ironing board, then through the kitchen floor, and was found two weeks later, still hot, dangling by its cord above the basement floor! Never was the iron hot enough to ignite cloth or wood of the ironing board or floor.

Electric switches, to gain approval, should not be fire hazards when made to carry one and one half times their rated current. Electric motors for use in dust-filled rooms must be constructed so that a commutator spark will not cause an explosion.

With 26 million homes in the United States using electricity, and an estimated 20 appliances in each, safety protection against fire hazard and shock is very necessary.

No one forces manufacturers to have their products tested. But you, the consumer, can force the issue by refusing to buy anything electrically operated which doesn't carry the UL stamp of approval. Many manufacturers, however, want their products tested, and pay to have it done by Underwriters' Laboratory — a non-profit, no-favorites-played organization.

About half the items fail their first trial at Underwriters' and are sent back to the manufacturer for redesigning. Redesigning costs money, but the manufacturer knows it's good business to give the buying public a safe product.

Once accepted by UL, an item is checked at the factory during production, and by inspectors who make purchases in all parts of the country. If the item at any time fails to pass, the UL label is withdrawn until the product is made safe.

Many, many things besides electrical products are brutally tested, from fire extinguishers to bullet resisting glass. All must meet rigid requirements to earn the UL label.

But electricity is what started the Underwriters' Laboratory over half a century ago. Insurance companies were worried by lots of fires at the first Chicago World's Fair, in 1893. The wiring for a new-fangled kind of electric lighting set up by Thomas Edison was causing the trouble. Investigation disclosed that fires might be prevented if lighting materials were tested before being used!

The Underwriters' Laboratory was born!

Lucky for you — and all of us!

Arts & Crafts Special!

Here's an item that stimulates the creative talents of your industrial arts class—gives students a handsome, individually designed desk set for gift or personal use.

We furnish:

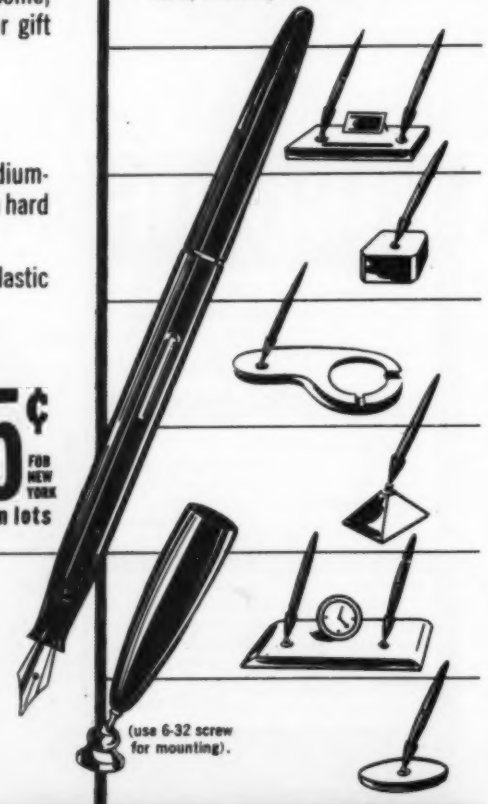
1. Guaranteed, high-quality iridium-tipped fountain desk pen with hard rubber feed and section.
2. Stream-lined, molded black plastic funnel.
3. Gold-plated swivel

Retail Value $1.50

all 3 for 45¢ FOR NEW YORK in dozen lots

Send $2 for 4 samples of No. 26R illustrated. Other pen and funnel combinations from 35c to $1.75.

BELOW—Some of the many designs that can be made out of leather, plastic, lucite, wood, metal, marble, onyx, clay, stone, ceramics, etc.



(use 6-32 screw for mounting).

MEMBER

Gilbert & Miller, inc.

PEN MAKERS TO THE TRADE SINCE 1927

693 BROADWAY, N. Y. 12, N. Y.

BIG BUSINESS

(Continued from page 110)

making instruction for girls and women. All these kinds of vocational training are most necessary and important. We always have a shortage of skilled workers!

(Continued on page 72A)

TYPICAL LUFKIN QUALITY TOOLS AS IMPORTANT IN THE TRAINING SHOP AS THEY ARE IN AMERICAN INDUSTRY

PRECISION TOOLS:
Micrometers
Squares, Combination, etc.
Calipers
Dividers
Steel Scales
Indicators
Protractors
Bevels
V Blocks
Clamps
Hold Downs
Scribers
Rules, Steel
Punches, Center & Drive Pin
Tool Sets

●

GAGES:
Center
Depth
Drill Grinding
Feeler
Planer
Radius
Screw Pitch
Shaper
Surface
Telescoping
Thickness
Height
Dial Indicator

●

MEASURING TAPES:
Chrome Clad Steel
Nubian Finish Steel
Stainless Steel
Engineers Steel
Surveyors Chain
Metallic and Other Woven Types
Pocket Steel & Woven
Lucas Mine

●

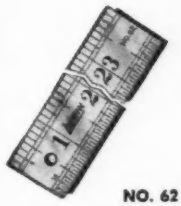
STEEL TAPE-RULES:
Chrome Clad
Nickel Plated
Stainless Steel

●

RULES:
"Red End" and Other Spring Joint Extension
Aluminum Folding
Boxwood & Caliper
Log & Board
Steel and Brass Manual Training
Etc., Etc.

NO. 34V
MANUAL TRAINING BENCH RULE

NO. 60
MANUAL TRAINING STEEL RULE


NO. 62
MANUAL TRAINING STEEL RULE

NO. 2204R
TEMPERED STEEL RULE

NO. 525
COMBINATION SQUARE SET

NO. 1941
MICROMETER

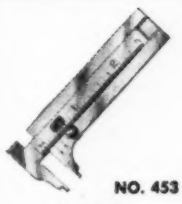
NO. 513
MICROMETER DEPTH GAGE

NO. 80A
INSIDE MICROMETER

NO. 52
INSIDE CALIPER

NO. 51
OUTSIDE CALIPER

NO. 50
SPRING DIVIDER


NO. 453
POCKET SLIDE CALIPER

NO. C-926
CHROME CLAD MEZURALL TAPE RULE

NO. X46F
"RED END" EXTENSION RULE

NO. C-253
CHROME CLAD STEEL TAPE

NO. 399
DIAL INDICATOR

NO. 36
CENTER GAGE

NO. 1 TOOL SET

SEND FOR GENERAL CATALOG

CHROME-CLAD — the easier to read, non-glare satin finish is furnished on all Lufkin Micrometers. Lufkin Chrome-Clad tapes are accurate and durable. The jet black markings stand out sharp and clear against the chrome-white background.

173

BUY LUFKIN TAPES • RULES • PRECISION TOOLS • From Your Industrial Distributor

THE LUFKIN RULE CO. • SAGINAW, MICHIGAN • 132-138 Lafayette St., New York City • Barrie, Ont.

BIG BUSINESS

(Continued from page 70A)

Today in certain parts of the United States bricklayers are paid $27 per day and they often get a bonus of $5 per day to encourage them to stick to some important construction job.

How can Big Business help vocational education? First, by co-operating with the trade unions and the vocational schools for the purpose of seeing that good vocational education is provided for all who want and need it. Second, by employing apprentices and compelling them to take related instruction in the technical aspects of their vocations. Third, by gifts of money, equipment, supplies, vocational school scholarships, and vocational school buildings. We have a few endowed vocational schools, such as the William Hood Dunwoody School of Mechanical Trades of Minneapolis, Minn., and the New York Trade School of New York City. But 95 per cent of all the vocational schools in the United States are public schools which are too few in number, and too poorly supported to do all the work they are expected to do.

Big Business should help vocational education and that right early. It is the key to the door of a better America.

THE ABSOLUTE VISCOSITY OF WATER AT 20°C.

A determination of the absolute viscosity of water at 20°C. with greater accuracy than ever before realized has recently been completed by J. F. Swindells of the National Bureau of Standards.[1] The new value is 0.01002 poise (dyne-seconds per square cm.) as compared with 0.01005 poise which has been generally accepted up to the present time. The absolute viscosity of water serves almost universally as the standard to which the viscosities of all other liquids are referred. Beginning July 1, 1952, the Bureau will use the new value as the primary standard for calibrating viscometers and for evaluating secondary standards which are issued as viscometer calibrating liquids. It is recommended that, in so far as possible, this change be adopted generally at the same time.

[1]For further technical details see "The Absolute Viscosity of Water at 20°C.," by J. F. Swindells, J. R. Coe, and T. B. Godfrey, J. Research NBS *48*, (1952), RP 2279.

About 75 per cent of last year's automobile accidents involved passenger cars.

Male drivers in 1950 were involved in more than 90 per cent of all U. S. automobile accidents.

PERSONAL NEWS

(Continued from page 26A)

♦ EDWARD GREEN, industrial co-ordinator of the Indianapolis public schools, resigned to accept an appointment with the Institute of Inter-American Affairs. Mr. Green has been associated with the Indianapolis schools for a number of years, both at the central office and Arsenal Technical Schools.

♦ JOHN J. MATTHEWS, vocational director of the Gary School, resigned to accept an appointment with the Institute of Inter-American Affairs. Mr. Matthews has been associated with the Gary schools for about eleven years as director of vocational education. Foreign service is not new to Mr. Matthews. He aided in the organization of the Apprentice Training Program now operating in the Panama Canal Zone at Balboa.

♦ A. LESTER CUNNINGHAM was appointed director of vocational education in the Gary public schools. He has been co-ordinator of trade and industrial education since 1943. Prior to that date he taught in the Horace Mann, Emerson, and Froebel High Schools of Gary.

Mr. Cunningham follows J. J. Matthews as director.

♦ WILLIAM P. GILLESPIE has been appointed sales manager of the hardware division of Henry Disston & Sons, Inc., 111-year-old manufacturer of saws, tools, and special alloy steels. He had been sales manager of Disston's power tool division for nearly two years.

JOHN H. DINGEE, former Disston advertising and sales promotion manager, has been appointed

(Continued on page 74A)

MAYLINE

Classroom Work Benches

Mayline work benches have tops made from kiln-dried Maple — Birch if desired. Base is built from select kiln-dried Oak. Extra sturdy frame members are assembled with heavy steel bolts.

Available as single or double bench.

REASONABLY PRICED!

Literature sent on request.

ENGINEERING MANUFACTURING CO.
623 No. Commerce St. Sheboygan, Wis.

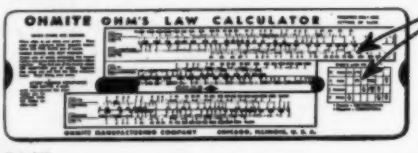
MAYLINE

MAYLINE MAYLINE

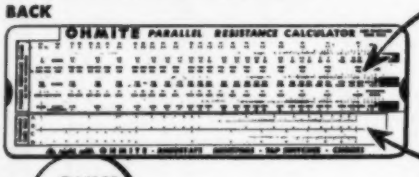
MAYLINE

HELPFUL CALCULATOR FOR STUDENTS Solves Ohm's law problems

FRONT



BACK

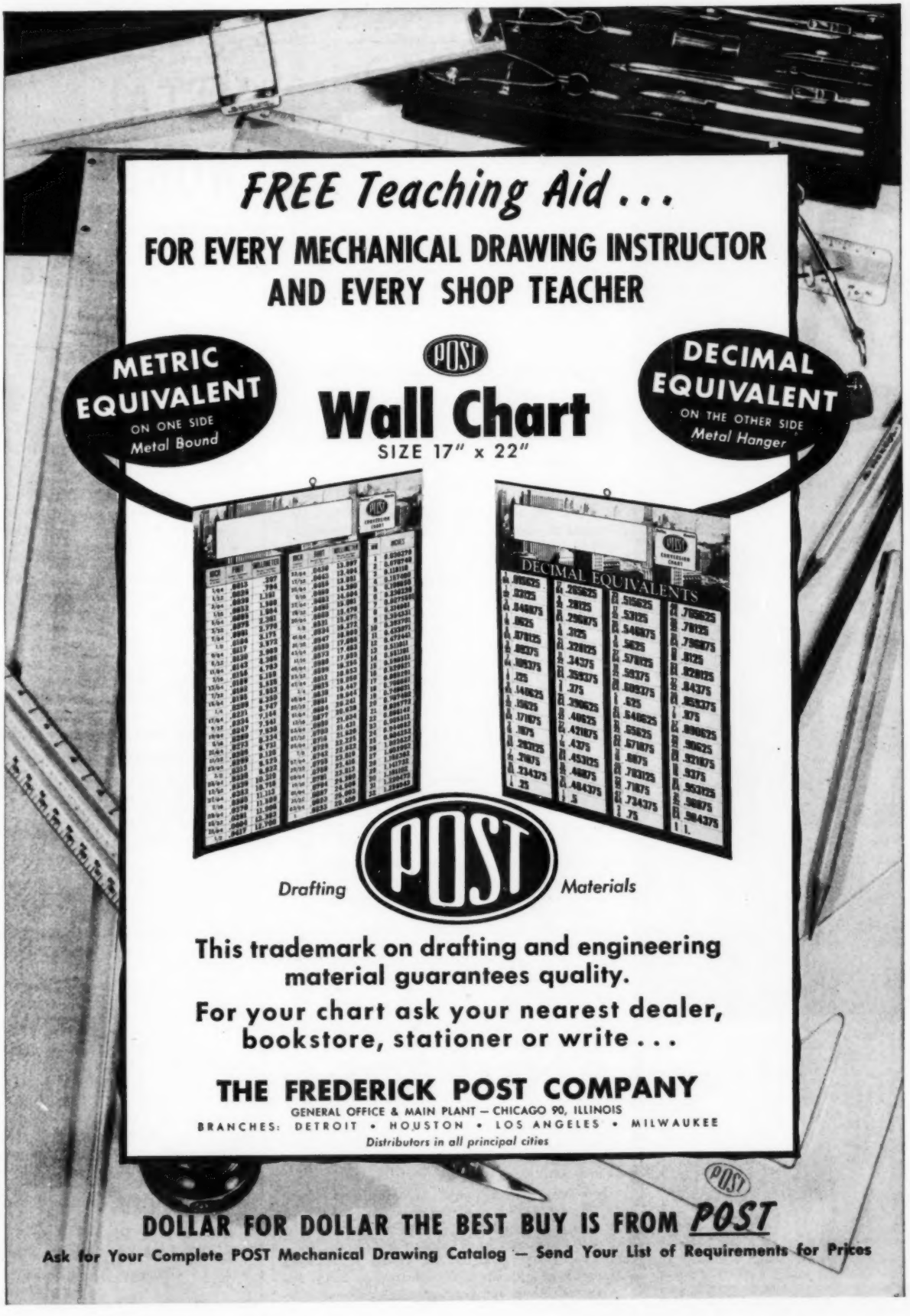


ONLY 25c

TEACHERS! Only 15c Each in Quantities of 25 or more

Here is the famous Ohmite calculator, popular the world over with engineers and students. Solves Ohm's Law and many parallel resistance problems—simply, quickly, and accurately—with only one setting of the slide. All answers read directly. Slide rule scales multiply, divide, find squares, square roots, etc. Handy size—9" x 3"—fits the pocket.

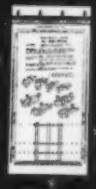
OHMITE MANUFACTURING CO., 4994 Flournoy St., Chicago 44, Ill.


FREE Teaching Aid . . .
FOR EVERY MECHANICAL DRAWING INSTRUCTOR
AND EVERY SHOP TEACHER
METRIC EQUIVALENT
ON ONE SIDE
Metal Bound
POST
Wall Chart
SIZE 17" x 22"
DECIMAL EQUIVALENT
ON THE OTHER SIDE
Metal Hanger
DECIMAL EQUIVALENTS
Drafting POST Materials
This trademark on drafting and engineering material guarantees quality.
For your chart ask your nearest dealer, bookstore, stationer or write . . .
THE FREDERICK POST COMPANY
GENERAL OFFICE & MAIN PLANT — CHICAGO 90, ILLINOIS
BRANCHES: DETROIT • HOUSTON • LOS ANGELES • MILWAUKEE
Distributors in all principal cities
DOLLAR FOR DOLLAR THE BEST BUY IS FROM POST
Ask for Your Complete POST Mechanical Drawing Catalog — Send Your List of Requirements for Prices

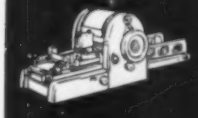
Make your own teaching aids

Each student can have his own individual copy of material you know is right when—

—you design the material yourself. It's done easily on an A. B. Dick Mimeoscope® illuminated drawing board with stencil drawing instruments. Then—



—take the A. B. Dick stencil of your material that fits your individual needs and—



—put it on an A. B. Dick mimeograph for fast, easy, low-cost production of—

— clear, sight-saving, black-on-white copies of material to satisfy your particular requirements.

Send the coupon below for complete information about MODERN mimeographing. All A. B. Dick mimeograph products are for use with all makes of suitable stencil duplicating products.

A·B·DICK

A. B. DICK COMPANY, Dept. 1A-352
5700 W. Touhy Ave., Chicago 31, Illinois

Without obligation, send me ( ) Catalog on the A. B. Dick illuminated drawing board ( ) Catalog on A. B. Dick drawing instruments and supplies ( ) information on A. B. Dick MODERN mimeographs.

Name_____

Position_____

School_____

Address_____

City_____ State_____

PERSONAL NEWS

(Continued from page 72A)

to succeed Mr. Gillespie as sales manager of the power tool division.

♦ G. WESLEY KETCHAM, supervisor of industrial arts of the Bureau of Youth Services, Hartford, Conn., has been granted a leave of absence until August 31, 1952. He has accepted a position with the National Association of Manufacturers, as educational director, serving the Northeastern area including New England.

♦ KENNETH H. LUNDY has been appointed acting supervisor of industrial arts for the state of Connecticut during the absence of G. Wesley Ketcham. Mr. Lundy will be available for consultation in the field of industrial arts and will administer the program of state grants for this program.

News Notes

♦ "Industrial Arts in Oklahoma" is a bulletin of some 130 pages which was published in November, 1951. It was prepared under the sponsorship of the Oklahoma Industrial Arts Association by a committee of 18 Oklahoma Industrial Arts teachers.

The opening chapters show the relationship of industrial arts and general education and give the teacher specific suggestions for attaining the objectives of industrial arts. One chapter deals entirely with existing programs in Oklahoma schools, lists their industrial-arts courses, and contains many floor plans of existing shops. One extensive chapter thoroughly covers the problems of planning a school shop. There are chapters on planning a course of study, community shop activities, the farm shop, professional organizations, teacher education, and the problem of state supervision of industrial arts.

Copies of the bulletin, "Industrial Arts in Oklahoma," may be obtained from Prof. C. L. Hill, secretary, Oklahoma Industrial Arts Association, A. & M. College, Stillwater, Okla. The price is $1 per copy.

♦ A minor in industrial arts is becoming the educational equipment of many of the Catholic Sisters of Michigan. The Felician Sisters, Madonna College, Plymouth, Mich., and the Sisters of the Immaculate Heart, St. Mary Academy, Monroe, Mich., Marygrove College, Detroit, Mich., are taking the lead in the industrial-arts movement. Other teaching communities are expected to follow in the near future.

During the past summer fifty nuns from various parts of the state assembled in Detroit for courses at Wayne University and Marygrove College. These classes were staffed by Dr. H. Silvius, Messrs. C. Sechrest, C. Falik, and D. Zwickey. Dr. Silvius and Mr. Zwickey act as advisers to the nuns participating in the project.

The drafting program of the Detroit Archdiocese, started in one Detroit school in 1946, has now spread into seventy schools in Michigan and neighboring states.

♦ The Milwaukee public schools are sponsoring a Television School of the Air on WTMJ-TV on successive Tuesdays at 12:30 on the television program known as "The Man Next Door."

On Tuesday, January 22, Joseph J. Lukowitz presented a lesson on the construction of the toy electric motor and countershaft which was pub-

METAL WORK for Industrial Arts Shops

By
Dewey Barich
and
L. C. Smith

JUST PUBLISHED: A book to meet today's objectives in industrial arts.

DESIGN: Successfully teaches students an appreciation of good design, and the principles back of such designs.

RELATED INFORMATION: Establishes in the student's mind the relationship of the industry to the world in which he lives.

SKILL: Covers all the information on the processes for making simple projects from copper, brass, aluminum, sheet metal, pewter, and iron.

OCCUPATIONAL INFORMATION: Includes a quantity of information on opportunities in the metal industry.

List price $2.00

Gentlemen:

Please send me an examination copy of:
METAL WORK FOR INDUSTRIAL ARTS SHOPS

Name_____

School_____

Address_____

City_____ Zone_____

State_____

AMERICAN TECHNICAL SOCIETY
Dept. W435
848 East Fifty-Eighth Street
Chicago 37, Illinois

lished in the October, 1949, issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

♦ The Audio-Visual Division of Popular Science Publishing Company announces release of new Teach-O-Filmstrip series for elementary arithmetic and science.

Local audio-visual dealers are now in a position to fill orders or give information on these new Popular Science series. Contact your community dealer or write direct to *Popular Science, Audio-Visual Division, 353 Fourth Ave., New York 10, N. Y.*

♦ Three new agricultural film-strip series in full natural color, Selection of Breeding Stock — Beef; Selection of Breeding Stock — Sheep; and Selection of Breeding Stock — Hogs, have just been released by the Audio-Visual Division, Popular Science Publishing Company.

Each of the three new livestock film-strip series consists of two full-length film strips, one devoted to the male and the other to the female of the species, with emphasis on points that teach students to recognize and evaluate best breeding characteristics of the animals.

Price of each series is $12 complete, available from *Popular Science, Audio-Visual Division, 353 Fourth Ave., New York 10, N. Y.*

♦ Coronet Instructional Films have produced a premilitary orientation film, "Are You Ready for Service?"

It is for high school students in their sophomore, junior, and senior years, and consists of four titles: *The Nation to Defend, What Are the Military Services?, When You Enter Service,* and *Military Life and You.*

A free brochure containing complete information on the "Are You Ready for Service?" series can be obtained by writing to *Coronet Films, Coronet Bldg., Chicago 1, Ill.*

♦ Details of its Second Annual Scholarships Awards contest to aid students, in their fourth or fifth year, who are taking subjects coming under the general category of "Tool Engineering," have been announced by the American Society of Tool Engineers.

Five awards will be made. To be eligible students must be taking one or more of such subjects in metal processing, tool design, plant layout, inspection, or advanced courses in manufacturing processes, in institutions accredited in engineering by the Engineers Council for Professional Development.

Of the five scholarships of $300 each ($100 per quarter), four will be awarded to students in the United States and one to a Canadian student.

Application for scholarships must be made not later than March 1, 1952. Final selection will be made by the National Education Committee of the A.S.T.E. on the basis of the student's own record, professional interests, work experience, personal need, and recommendations of faculty members.

Applications and detailed information are available from *American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.*

♦ A special current events test, to be made available annually for spring testing, has been announced by Science Research Associates. This new instrument is designed to assess students' understanding of important news developments and their consequences.

Publication of the first form is expected in February, and a new, validated edition will be issued each future year at the same time. The test covers two areas: knowledge of social de-

(Continued on next page)

Ready in April

BEGINNING ELECTRICITY

by J. R. EATON

Written simply enough to be understood by anyone who can add and subtract, this book explains the principles, construction, and operation of the basic electrical devices and appliances. While the mechanical arrangement of parts and the operation of each device are described, emphasis is on basic principles. The book provides a thorough foundation in electricity for those preparing for the electrical trades. The author has been conducting extension courses, centering out of Purdue University, given to numerous groups being trained for maintenance and service work on the electronic and electrical installations now increasingly used throughout industry.

Special new low prices for schools

Many of our recent and standard books for specialized trade training are now available at new low prices for text use, among them: —

Aircraft Mechanic Series *by R. H. Drake*

*formerly $28.40 a set**
NOW $15.96 per set

Aircraft Woodwork
Aircraft Engines
Aircraft Welding
Aircraft Sheet Metal
Aircraft Electrical Systems, Hydraulic Systems, and Instruments
Aircraft Maintenance & Service
Aircraft Engine Maintenance & Service

Texts for all or any part of the work required for CAA aircraft and engine mechanics certificates and special ratings. Full instruction is given in each book on basic principles, materials, tools, and specific construction and maintenance techniques.

Machine Shop Operations *by L. E. King*

formerly $4.12 a set
NOW $1.80 a set

Lathe Operations
Shaper Operations
Milling Machine Operations

Well organized for shop courses taught either on the production or the project plan, these books show, step by step, how to perform each operation on each tool. The necessary technical data and calculations are given at the points where they are used. There are many clear, detailed illustrations in each manual.

Direct Current Motor Manual *by H. S. Dusenbery*

formerly $3.12
NOW $2.72

Full, up-to-date instruction on the electrical principles, construction and maintenance of d-c motors, generators, and their modern electronic control equipment.

Practical Marine Electricity *by S. N. LeCount & H. S. Dusenbery*

formerly $3.92
NOW $1.60

A clear and thorough text on electrical principles and on the operation and maintenance of each piece of electrical equipment found on merchant ships and in the shipyard.

Motor Tune-Up Manual *by R. J. Everest*

formerly $4.40
NOW $3.60

An outstandingly complete, understandable, and well illustrated text on the electrical and mechanical principles of each part of the modern automobile engine, with full instruction on tune-up jobs.

Voltage Regulator Manual *by R. J. Everest*

formerly $2.28
NOW $2.00

A text and handbook on a comparatively new and complicated part of the auto engine, and on its allied parts — the battery and generator. Clear directions for locating trouble in and for testing and adjusting the Ford, Delco-Remy, and Auto-Lite regulators.

**All prices net, f.o.b. New York.*

MACMILLAN

60 fifth Avenue New York 11

NEWS NOTES

(Continued from previous page)

velopments and knowledge of scientific developments. Special design advantages include reusable booklets and inexpensive self-scoring carbon answer pads.

For further information write to Information Director, *Science Research Associates, 57 West Grand Ave., Chicago 10, Ill.*

♦ The McGraw-Hill Book Company purchased the high school book list of Harper & Brothers on January 2, 1952, and started billing and shipping the books on that date.

The transfer includes all inventory and publishing rights for a list of about 80 titles used in junior and senior high schools. Their subjects include science, mathematics, social studies, English, and modern languages.

♦ Nine colleges in the Middle West and South are co-operating with Illinois Institute of Technology in a combined program in liberal arts and engineering.

The program enables a student to attend the co-operating college for three years and then transfer to Illinois Tech for two additional years. After these five years, the student is awarded a bachelor of arts or science degree from the liberal arts college and a bachelor of science in engineering degree from Illinois Tech.

The student is thus able to obtain a background in liberal arts and humanities and at the same time gain a more specialized degree in engineering.

The nine co-operating colleges are: Aurora college, Aurora, Ill.; Carroll college, Waukesha, Wis.; Carthage college, Carthage, Ill.; Coe college, Cedar Rapids, Iowa; Illinois college, Jacksonville, Ill.; Lake Forest college, Lake Forest, Ill.; Roosevelt college, Chicago; Washington and Jefferson college, Washington, Pa.; and Westminster college, Fulton, Mo.

♦ Two hundred twenty-three schools were listed on the National School Safety Honor Roll for the 1950–51 school year.

The Honor Roll is a National Safety Council activity open to all schools which have a subscription to one of the Council's school safety services. Schools which receive this recognition are listed on the Honor Roll and receive an Honor Roll Certificate with the school name and number of years of consecutive participation.

The Honor Roll serves to award recognition to safety programs of schools, to suggest improvements in these programs, and to stimulate increased student interest in safety.

To apply for listing on the Honor Roll a local committee must evaluate its school safety program and submit this evaluation to the Honor Roll Judges together with a testimonial asserting that the committee believes the program worthy of recognition.

For further information on this important safety movement, write to *National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.*

♦ California leads the nation in training its high school students to be safe drivers, the Governor's Highway Safety Conference was told recently as the state received its third "superior award" in as many years in the National High School Driver Education Award Program, sponsored by the Association of Casualty and Surety Companies, 60 John Street, New York 38, N. Y.

The 110,953 students enrolled in driver-training courses during the 1950–51 term in California was the largest state group of high school trainees in the nation.

New York and Massachusetts were third and fourth in total enrollment with 43,653 and 43,634, respectively.

California's student enrollment in driver-training courses jumped 26,434 over the previous term. At the same time the number of schools offering driver education was increased by 21, from 397 to 418 of the state's 435 secondary schools. Enrollment last term represented more than 100 per cent of the 109,403 eligible students because the driving course was taken by some boys and girls above or below the grades in which the training is usually given. In California driver training is required for graduation from high school.

♦ Ceco Steel Products Corporation of Chicago has established two engineering scholarships at Illinois Institute of Technology.

Each scholarship provides $1,000 for the junior and senior years to a student enrolled in the civil engineering or general engineering curriculum.

Continuation of the scholarship through the senior year will depend upon the student's record during the junior year.

The awards will be made beginning in September to worthy and needy students.

Scholarship winners will be offered employment at Ceco's Chicago plant for eight or more weeks during the summer.

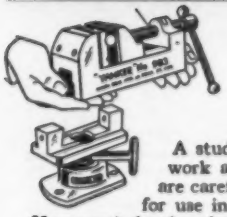
♦ An effective presentation of the advantages of designing products around extruded aluminum parts is woven into the new movie, "The Shape of Things to Come," just released by Reynolds Metals Company.

This 16mm. full-color motion picture with sound runs about 30 min. It will be loaned to

(Continued on page 78A)

"YANKEE" VISES

good teaching tools
ACCURATE AND SAFE



A student learns faster with a vise that lines up work accurately. He's safer, too. "Yankee" Vises are carefully machined on base, sides and front end, for use in any position. Each vise is furnished with V-grooved, hardened steel block for rounds. Available with and without swivel base.

Versatile, too. Can be used for bench or machine work. Easily detachable from swivel base without disturbing work, for use on milling machine, drill press, surface grinder, etc. Adaptable as low-cost jigs or fixtures. Four jaw widths; 1½", 2", 2¾" and 4".

A postcard will bring you the "Yankee" Tool Book FREE! North Bros., 206 West Lehigh Ave., Phila. 33, Pa.

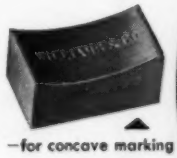
NORTH BROS. MFG. CO.
Philadelphia 33, Pa.

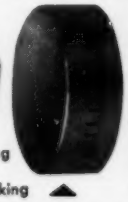
"YANKEE" TOOLS NOW PART OF STANLEY
THE TOOL BOX OF THE WORLD

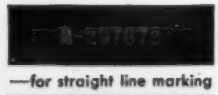
For Safe, Fast, Economical Marking . . .

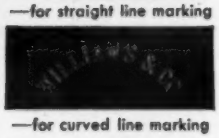
"SAFETY"
WEDGE GRIP
STEEL HAND STAMPS

Made with two or more characters, trade mark designs, Gothic, Roman, or script style lettering to suit any requirement. Sizes from 1/64" and up. Non-spalling, non-mushrooming features assure long, safe service on all types of marking.


—for concave marking

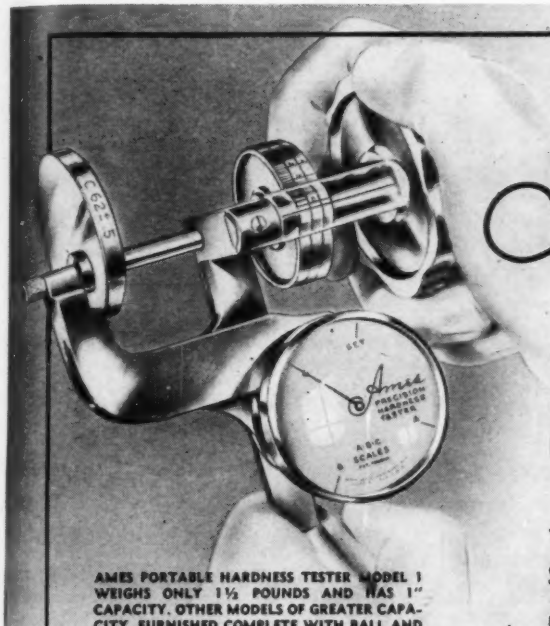

—for convex marking


—for straight line marking


—for curved line marking

Write for quotation on your requirements.

M.E. CUNNINGHAM CO.
SAFETY STEEL STAMPS
115 East Carson Street · Pittsburgh 19, Pa.



AMES PORTABLE HARDNESS TESTER MODEL 1 WEIGHS ONLY 1½ POUNDS AND HAS 1" CAPACITY. OTHER MODELS OF GREATER CAPACITY. FURNISHED COMPLETE WITH BALL AND DIAMOND PENETRATORS, ANVILS, AND TEST BLOCKS, IN WOODEN CARRYING CASE, FOR TESTING DIRECTLY IN ALL ROCKWELL SCALES.

TEACH ROCKWELL HARDNESS TESTING IN THE CLASSROOM WITH

Ames PORTABLE HARDNESS TESTERS

All engineering students should understand Rockwell Hardness Testing of metals. It is an important subject which can now be taught in the classroom with Portable Hardness Testers.

They are light in weight, easy to use, durable and very accurate. Hundreds of them now used in industry. Students become familiar with hardness testing and many practical applications. Write for Hardness Tester booklet and complete information.

AMES PRECISION MACHINE WORKS

Makers of Precision Bench Lathes and Milling Machines

WALTHAM 54, MASSACHUSETTS

YOU WILL FIND STERLING FLASKS IN MORE THAN 4500 FOUNDRIES

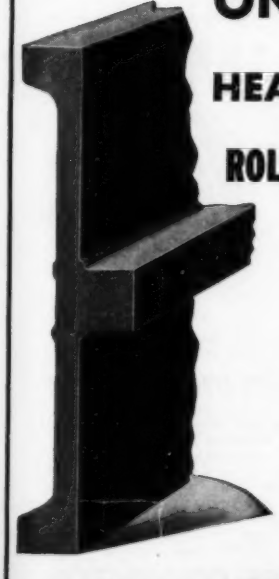
ONLY STERLING

Gives You

HEAVY-DUTY FLASKS

Engineered from

ROLLED STEEL CHANNEL



Almost a half century of "Know-How" assures precision-built steel flasks fabricated to highest quality standards. Sterling Flasks have these patented, life-prolonging features: all-steel welded construction . . . solid reinforcing bars . . . heavy rolled steel flanges . . . square corners . . . full-width bearing. Available in a variety of styles and shapes. Write for catalog.

STERLING WHEELBARROW CO.

Milwaukee 14, Wis., U. S. A.

HARDWOODS

for SCHOOLS and SHOPS

We have made a specialty of serving schools with their lumber needs. More than 50 years of experience in supplying lumber to school shops is your assurance that you will get quality lumber at the right price. Sixty-five per cent of our lumber stock is under shed which means lumber that can be used immediately upon delivery.

Write us for quotations on your entire requirements. We are sure you will be interested in our prices and service.

THE TEGGE LUMBER CO.

1500 W. Bruce Street Milwaukee 46, Wisconsin

NEWS NOTES

(Continued from page 76A)

technical societies, schools, colleges, and other interested groups without charge. For bookings, write *Motion Picture Department, Reynolds Metals Co., 2500 South Third St., Louisville 1, Ky.*

♦ A new 64-page catalog, "Westinghouse Laboratory Apparatus for Educational Institutions," is available from the Westinghouse Electric Corporation.

The catalog was prepared with the special needs of educational institutions in mind and lists for convenient reference those items of Westinghouse manufacture that are adapted to use in educational laboratories.

The equipment is described by means of line drawings, half tones, and schematic diagrams; charts which give specification data, ratings, and ordering information; and lists of available accessories. Suggestions also are given as to the various laboratory tests which can be conducted with the equipment.

For a copy of Catalogue 190, write the *Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.*

♦ Science Research Associates of Chicago, publishers of tests for business and industry, culled out some interesting new answers after surveying 125,000 workers. This new morale-measuring instrument called the *Employee Inventory,* is not a test, and has no right answers or wrong answers. Workers are asked to indicate in a 4-page booklet whether they agree, disagree, or are undecided about statements given in the inventory. This new questionnaire is designed to help companies find out what their employees honestly think about their jobs, their pay, their bosses, and the company they work for. It is available from *Science Research Associates, 57 West Grand Ave., Chicago 10, Ill.*

♦ A new application bulletin, descriptive of Rust-Cure antirust paint, is announced by The Monroe Co. Inc., Cleveland, Ohio.

This rust-cure, the manufacturer claims, can be applied on rusted surfaces without wire-brushing, scraping, or sandblasting.

It also is claimed that Rust-Cure seals rusted surfaces and retards further rusting action. It is available in black, aluminum, and clear and can be applied by brush, dip, or spray methods, indoors or out.

Write for a copy of Bulletin 136–11 to *The Monroe Co. Inc., 10703 Quebec Ave., Cleveland 6, Ohio.*

Through the League of Red Cross Societies and with the co-operation of national Red Cross societies, the American Red Cross aided victims of the Korean war, famine in India, floods in Pakistan, hurricane in Jamaica, and earthquake in El Salvador. In addition to aid in time of crisis, national Red Cross societies continued to help each other in the development of programs and services, with the American Red Cross especially active in this field. — *American National Red Cross.*

New Publications

Manufacturing Processes

By Myron L. Begeman. Cloth, 608 pp., 6¼ by 9¼ in., illus., $6. John Wiley & Sons, Inc., New York 16, N. Y.

This is the third edition of this text on industrial production.

It embraces the wide field of manufacturing processes and the machines presently available for performing the many intricate jobs found in the modern production plant.

The present edition contains several new chapters and considerable revision of the material found in the two former editions.

The book is profusely illustrated.

Simple Upholstery

By Dorothy M. Hart and John Halliday. Paper cover, 60 pp., 5⅜ by 8½ in., illus., $1.25. Chas. A. Bennett Co., Inc., Peoria 3, Ill.

A compact little book which describes how to select materials for upholstering; how to make a padded top for a footstool; and how to set the springs for box seats, for chairs, stools, or work boxes. It also shows how ready-made frames are used in upholstering, and how loose covers are made.

State Provisions for Financing Public-School Capital Outlay Programs

By Erick L. Lindman and Clayton D. Hutchins of the Office of Education and Edgar L. Morphet

(Continued on page 80A)

This Haul Beats All of Madame's Jewels ...'cause

PROTO means PROfessional TOols!

You get true *professional* quality in PROTO tools, because they are designed and built to meet the exacting requirements of tool experts. Modern user-tested designs, PROTO-specified alloy steels, proper forging and heat treating, and extreme care in all manufacturing steps result in tools that are extra strong, accurate, easy to handle and long-lived. Make your PROTO dealer's store your *professional tool* headquarters. Send 10¢ for 68-page catalog to

PLOMB TOOL COMPANY
2204P Santa Fe Ave., Los Angeles 54, Calif.

The PROTO Line Includes Wrenches, Pliers, Screwdrivers, Punches, Chisels, Sockets & Handles and Many Others.

Eastern Factory—Jamestown, N. Y.

5281

PROTO Professional Quality TOOLS LOS ANGELES MADE IN U.S.A.

HARPER ELECTRIC KILNS

1½ cu. ft. Kiln installed at State Teachers College, Buffalo, New York.

Contribute
to the best CERAMIC TRAINING

Harper

BECAUSE they provide a wide temperature range within which all types of high and low temperature Ceramic ware can be *properly* fired.

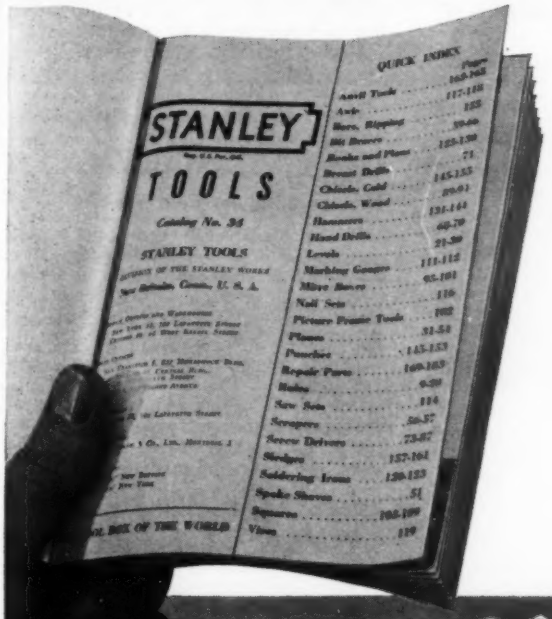
BECAUSE they are clean, noiseless and safe to operate as an electric stove.

BECAUSE they are expertly designed and sturdily constructed to operate dependably for many years with a minimum of maintenance.

Leading SCHOOLS and Universities are using HARPER ELECTRIC KILNS to provide their students with the finest Ceramic training and also because they have found Harper Kilns to be more economical to operate in the long run.

Write for information on Harper Kilns to meet your Ceramic Department requirements. They are available in sizes from ½ to 18 cubic feet for operation to 3 top temperatures, 2100°F., 2500°F. and 2750°F.

HARPER ELECTRIC FURNACE CORPORATION
Dept. 3 • 39 River Street • Buffalo 2, New York



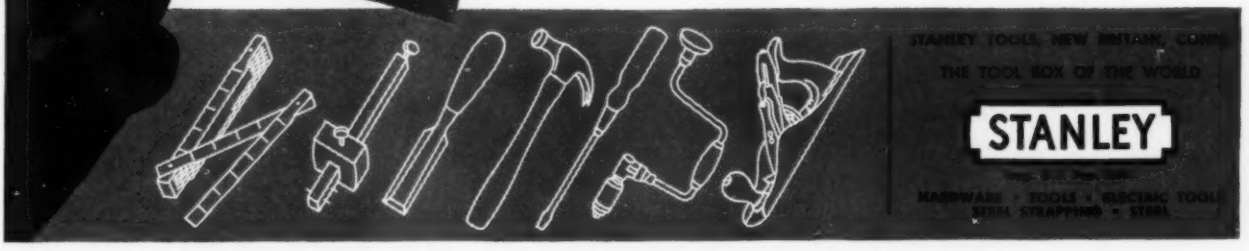
SPECIFY QUALITY TOOLS

Use catalog No. 34
with special school index to select STANLEY and "YANKEE" tools, RUSSELL JENNINGS bits

- For Woodworking and Farm Shops
- For Electrical Shops
- For Sheet Metal Shops
- For Automobile Shops
- For Machine Shops
- For Forge Shops

With the special school index you can easily specify the particular tools you need for your shop. Famous "YANKEE" Tools and RUSSELL JENNINGS BITS are included, for your additional convenience. Write us today. Stanley Tools, Educational Dept., 104 Elm Street, New Britain, Conn.

VISUAL TEACHING AIDS AND PROJECT PLANS AT COST



NEW EDUCATIONAL TEXTBOOK EXPLAINS BAND TOOL SELECTION AND USE

GUIDES STUDENTS IN BAND SAWING, AND BAND MACHINING APPLICATIONS

HERE'S 160 pages of valuable information to help students increase their band machining "know-how". It tells the proper band tool to use, speeds, pitches, feeds, coolants and other factors necessary to saw, slice, file, grind, polish or hone any material. Sawing techniques, terminology and surface finish are also explained. Price, $2.00 each. Send orders to:

58-10

DoALL

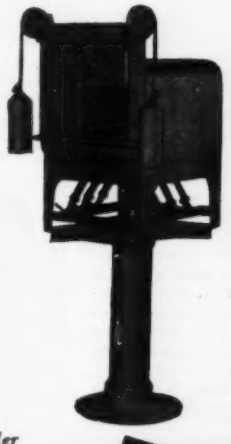
THE DoALL COMPANY
254 N. Laurel Ave.
Des Plaines, Illinois

EASY FAST

Now **ONE** Furnace for teaching a variety of heat treating techniques

THE JOHNSON No. 706

Teach a wider range of hardening, tempering and annealing with the Johnson No. 706. Six powerful direct jet burners deliver easily controlled temperatures from 300° to 1850° F. Uses natural, artificial, mixed, or bottled gas. Economical in operation. Firebox 7 x 13 x 16½ inches.



No. 706 Pedestal (illustrated) $278.00

No. 706 Bench $250.00

No. 654-Four Burner with 5 x 7¾ x 13½ inch firebox Pedestal $150.00

Bench $124.00

All prices F.O.B. Factory

Renew the efficiency of your older Johnson Furnaces

Write for details on low cost factory rebuilding.

FREE CATALOG

JOHNSON GAS APPLIANCE CO.
585 E AVENUE N.W. CEDAR RAPIDS, IOWA

NEW PUBLICATIONS

(Continued from page 78A)

and Theodore L. Reller of the University of California. Office of Education Bulletin 1951, No. 6, 170 pp. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., 40 cents.

This study presents the existing policies and practices of 19 states which participate in the financing of local schoolhouse construction. It shows the need for properly developed state programs of financial support for capital outlay and summarizes some of the significant developments in this area. The Office of Education report of the study also explains the plans now in operation, analyzes those plans to show some of the strong and weak points, and presents some of the criteria that can safely be followed on the basis of experience and evidence collected to date.

Building Practice Manual

By Roy W. White. Cloth, 307 pp., 6¼ by 9½ in., illus., $3.40. D. C. Heath and Co., Boston, Mass.

A book specially designed for students, apprentices, and mechanics engaged in learning or working at the building trades. It will also be found useful as a reference book for those engaged in estimating building materials and costs.

The book contains almost 300 architectural drawings, and the appendix consists of 80 tables of standard sizes of materials, proportions and quantities of ingredients for mixing concrete, cement, plaster, stucco, and the like.

The Financing of State Departments of Education

By Fred F. Beach and Clayton D. Hutchins. Office of Education Miscellany No. 15, 1951, 83 pp., 45 cents. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

This report was prepared with the co-operation of the study commission of the National Council of Chief State School Officers. It constitutes the third publication in the state department of education series. Two already issued are: The Structure of State Departments of Education, 1949, 50 cents; and The Functions of State Departments of Education, 1950, 40 cents.

Education in Rural and City School Systems: Some Statistical Indices for 1947–48

By Rose Marie Smith. Office of Education Circular No. 329, 1951, 13 pp., 15 cents. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

This publication furnishes pertinent statistics for the school year indicated above, and is the first since the 1941–42 report. It includes data from 36 states.

Know Your Fabrics

By Lucy D. Taylor. Cloth, 366 pp., 6¾ by 9¾ in., illus., $6.75. John Wiley & Sons, Inc., New York City.

This book with its clear description and fine illustrations will delight interior decorators as well as housewives and homeowners who have an eye for beauty.

Section 1 describes the standard fabrics and how they may be put to use in the home.

Section 2 explains how the characteristics of historic fabrics may be adapted to the personality of individual persons and uses.

Section 3 describes what fabrics are especially adaptable to be used for upholstering the furniture of today.

Glovemaking for Beginners

By Natalie S. Woolf. Paper, 104 pp., 7¾ by 10¼ in., illus., $1.50. McKnight & McKnight Publishing Co., Bloomington, Ill.

The author of this book is a teacher, a custom glovemaker, and a glove designer. The material in the book was thoroughly tried out in the classroom before the manuscript was submitted for publication. The illustrations show 24 gloves styled by the author and the full-size patterns presented are for men, women, and children.

The instructional material is divided into 23 units. The book also contains a glossary.

Technique in Ripsawing

By John E. Hyler & Associates, Lock Box 112, Peoria, Ill. Paper cover, 42 pp., 8⅛ by 10⅝ in., illus., $1.75.

A very fine book on related information for use with the table saw. In its 14 chapters, ripsaw tooth forms, tooth setting, safe ripping practices, ripping cupped stock, circular gang saws, special match ripping, taper and wedge ripping, ripping round and tapered columns, beveling and cornering, and special sawing with hand-feed ripsaw, are covered.

(Continued on page 84A)

BUSS No. 4L PLANER

A LOGICAL CHOICE FOR SCHOOL SHOP TRAINING

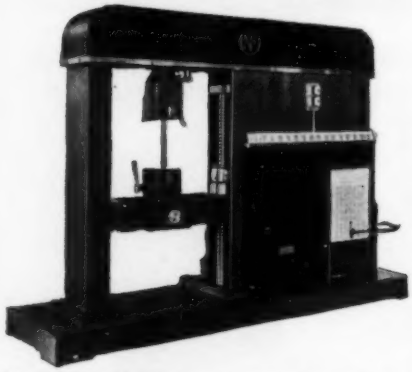
A medium size, wedge-adjusted planer that is widely used in industry. Equipped with sectional infeed roll, sectional chip-breaker and four driven rolls which permit planing pieces of varying thickness without danger of kick-back. Has built-in knife grinder, allowing the instructor to keep knives sharp with little effort and the student to do good work. Engineered for maximum safety. Sturdy, semi-steel cast frame. Priced within the budget requirements of the average school. Write for complete facts.

BUSS MACHINE WORKS

254 EIGHTH ST., HOLLAND, MICHIGAN

NATIONAL FORGE

UNIVERSAL TESTING MACHINE



Model TMU — Only 44 in. High, 15,000-lb. or 30,000-lb. Capacity

Ideal for classroom instruction. Compact, rugged, dependable. A.S.T.M. accuracy. Three scale ranges on each machine give widespread utility. Controls are simplified, with safety cutouts. Infinitely-variable speed. Moderate in price.

WRITE FOR BROCHURE 501

Testing Machine Division

NATIONAL FORGE AND ORDNANCE COMPANY

Dept. IA, Irvine, Warren County, Pennsylvania

McKnight Publications

GENERAL SHOP WOODWORKING

By FRYKLUND & LaBERGE. For text use in courses to teach fundamentals of hand woodworking. Clear instructions made easier to understand by line drawings. Provides information on sources, processing and uses of wood. Describes many woodworking occupations. Includes layout, marking gauges, planing, squaring stock, sharpening edge tools, miter joints, moldings, stains, fillers, hardware, upholstery, etc. 25 projects. Send for approval copy. $1.25. Clip this.

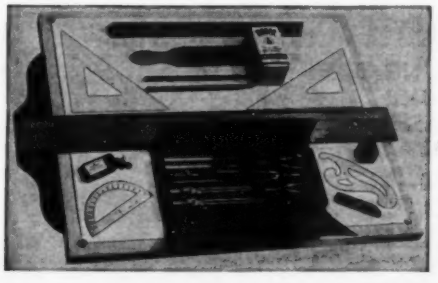
- **General Shop Metalwork**
  By DRAGOO & REED. Basic text for beginning metalwork. 28 projects. 104 pages. $1.25.
- **General Shop Electricity**
  By DRAGOO & DRAGOO. Beginner's text in practical electricity. Used in many classrooms, 124 pages. $1.25.
- **General Drafting**
  By FRYKLUND & KEPLER. A textbook for the first year of drafting. Easy to read. $1.25.
- **General Printing**
  By CLEETON & PITKIN. Standard text for beginning students of printing. 227 photos, 20 drawings. 160 pages. $1.80.
- **Home Economics**
  By J. C. WOODIN. Meets need for practical course in household mechanics. For both boys and girls. 104 pages. $1.25.

Check the Books You Want

☐ HOME MECHANICS	$1.25
☐ MACHINE WOODWORKING	3.00
☐ GENERAL SHOP WOODWORKING	1.25
☐ PROJECTS IN WOODWORK	3.75
☐ GENERAL DRAFTING	1.25
☐ PROBLEMS IN DRAFTING AND DESIGN	1.00
☐ DRAWING APTITUDE TEST — SPEC. SET	.35
☐ SPUR GEARING	1.00
☐ METALWORK, TECH. & PRACTICE	4.40
☐ GENERAL SHOP METALWORK	1.25
☐ SHEET METALWORK	1.25
☐ BENCH METALWORK	1.00
☐ ETCHING, SPINNING, RAISING & TOOLING METAL	1.25
☐ UNITS IN PATTERNMAKING & FOUNDING	1.00
☐ UNITS IN FORGING AND WELDING	1.00
☐ GAS & A.C. ARC WELDING & CUTTING	1.25
☐ MACHINING OF METAL	3.50
☐ MACHINE SHOP PROJECTS	1.20
☐ ENGINE LATHE OPERATIONS	1.80
☐ BLUEPRINT READING, CHECKING & TESTING	2.20
☐ READING AIRCRAFT BLUEPRINTS	2.00
☐ GENERAL ELECTRICITY	1.00
☐ GENERAL SHOP ELECTRICITY	1.25
☐ PROJECTS IN ELECTRICITY	1.20
☐ PRINCIPLES OF ELECTRICITY	1.60
☐ PRACTICAL PHOTOGRAPHY	4.00
☐ APPLIED FUNDAMENTALS OF MACHINES	2.50
☐ METHODS OF MEASUREMENT	1.20
☐ GENERAL PRINTING	1.80
☐ SUPERVISOR'S JOB IN INDUSTRY	1.00
☐ GENERAL BOOKBINDING	1.20
☐ GENERAL LEATHERCRAFT	1.50
☐ LEATHERCRAFT, TECHNIQUE & DESIGNS	5.00
☐ LEATHER DESIGNS	2.00
☐ GENERAL PLASTICS	1.75
☐ PRACTICAL SIGNS & POSTER WORK	1.50

McKNIGHT PUBLISHING COMPANY

Dept. 20A, Market & Center Street, Bloomington, Illinois



WEBER DRAWING MATERIALS for Mechanical Drawing Classes

For precision student work make WEBER – COSMOS DRAWING INSTRUMENTS (Original Round System) the heart of your equipment. Use WEBER – COSMOS INSTRUMENTS with the other Weber drawing necessities, including T Squares, Triangles, Curves, Scales, Slide Rules, Drawing Boards, and Waterproof Drawing Inks for top performance at school budget prices.

Weber – Cosmos Drawing Instruments are available in sets, and separate pieces; also a full line of replacement parts. Superb in workmanship and materials.

Descriptive data on request.

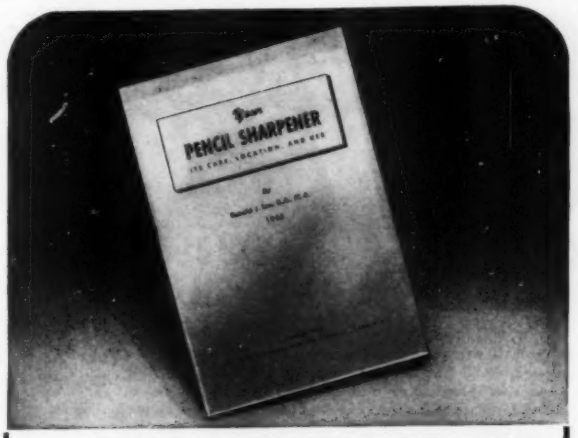
SCHOOL ART AND DRAFTING ROOM FURNITURE

F. WEBER CO. EST. 1853

PHILADELPHIA 23, PENNSYLVANIA

St. Louis 1, Mo. Baltimore 1, Md.

Patronize your nearest Weber Dealer



A *FREE* BOOKLET ON PENCIL SHARPENERS

Here is a worth while educational report by DONALD J. LEU free of advertising that every user of Pencil Sharpeners should read. It is an unbiased report on pencil sharpeners, regardless of the make and tells you how to use them to greater advantage through proper selection, location, care and maintenance.

YOU CAN'T BUY BETTER THAN A BOSTON!
Backed by a Full Year's Guarantee

C. HOWARD HUNT PEN CO.
CAMDEN 1, N. J.

Also Manufacturers of Speedball Pens & Products—Hunt Pens

WRITE FOR CATALOG

BOSTON PENCIL SHARPENERS

REMEMBER THE NAME . . . Rubyfluid

the easy-to-use Soldering Flux for neat strong unions.

Use Rubyfluid Flux — liquid or paste — to get neat, strong unions speedily and easily. Rubyfluid is a special fast acting formula, wets out freely, is free from harmful and objectionable fumes, economical to use. Try it — send $1 for special offer — 1 pt. liquid, ½ lb. paste flux and helpful booklet.

For Stainless Steel use *Ruby's Stainless Steel Flux*, perfected for that metal.

77 S. McDowell Street Columbus 8, Ohio
RUBY CHEMICAL CO.

Rubyfluid

Buy your
LUMBER
direct from the
manufacturer

T. A. FOLEY LUMBER CO., INC.
Lock Drawer No. 336 Paris, Illinois

•

Also Plywood and Dowels

"PAID FOR ITSELF ON ONE JOB!"

Foredom FLEXIBLE SHAFT MACHINES

have many time-saving applications but users often find a Foredom REPAYS ITS COST on ONE JOB through eliminating an expensive disassembly and re-set job on such tasks as removing high spots on gears and touching up tools or cutters in a production set-up. The secret's in Foredom's extra small handpieces which handle like a pencil and penetrate into spots inaccessible for other tools.

Indispensable for "SMALL WORK" GRINDING AND FINISHING JOBS

Foredoms are profitable additions to ALL 3 departments — Production, Tooling and Maintenance. 5 HANDPIECE TYPES (all instantly interchangeable) produce versatility to a marked degree.

Students trained in the use of Foredoms find the experience gained a valuable asset when they start their careers.

Quality Tested Since 1922

Foredoms are ideal for the internal carving of plastics craft. Mail Coupon for catalog.

FOREDOM ELECTRIC CO., Dept. N-6915
27 Park Place, New York 7, N. Y.
Please send me Illustrated Cat. No. N-6914
School ..... Name .....
Address .....
City & Zone ..... State .....

New TEXTBOOK
TAILORING SUITS THE PROFESSIONAL WAY

By Clarence J. Poulin, Custom Tailor. Complete and practical coverage for apprentices, lay students and trade school classes. Tells in simple understandable language every operation in making coats, trousers, vests and skirts. Shows faster ways of working, more easily analyzed methods of drafting, clearer understanding of coat mechanics — all basic operations with FITTING EXPLAINED IN DETAIL. Hundreds of step-by-step diagrams . . . many photos. Hints on teaching procedure are provided for instructors. $4.50

New FILMSTRIPS—
"Exploring Electricity"

Stimulating and instructive, these two filmstrips are based on the popular textbook, INDUSTRIAL ARTS ELECTRICITY by Lush and Engle. The strips make electricity come "alive," attractive and interesting. Part I covers the sources of electricity — magnetism, dry cell, transformer, circuits — and how they are used. Part II tells how electricity is conducted, the making of splices, operating motors, heating devices, etc. Price, set of two strips, ... $6.25

SCHOOL EXPERIMENTS WITH ALTERNATING CURRENT

New textbook with 110 interesting experiments that stimulate interest in this important field. Examines alternating current . . . its magnetic effect and heating effect; ammeters and voltmeters; frequency measuring; transformers; chokes; condensers; phase difference; AC motors; electricity distribution; AC rectification and wireless valves. By W. E. Pearce $2.75

INDUSTRIAL ARTS ELECTRICITY

Lush and Engel, $2.48; 5 or more, $1.88 ea.

CHAS. A. BENNETT CO., Inc.
861 Duroc Bldg., Peoria, Ill.
Formerly The Manual Arts Press

Send ☐ TAILORING SUITS THE PROFESSIONAL WAY, 4.50
☐ SCHOOL EXPERIMENTS WITH AC, $2.57
☐ INDUSTRIAL ARTS ELECTRICITY, 2.48
☐ FILMSTRIPS, "EXPLORING ELECTRICITY, $6.25
☐ $ ..... enclosed. ☐ Send COD.
☐ Send for FREE exam.

Name .....
Address .....
City ..... State .....

NEW! NEW! NEW!

● Six new books of interest to every industrial arts and vocational shop teacher.

AUTOMOBILE BODY REPAIR and PAINT GUIDE — ATHANSON

THE CIRCULAR SAW — HAINES

THE WOOD-TURNING LATHE — HAINES

CHAINS and BEADS — PACK

HOW TO BUILD GAMES and TOYS — PELTON

MAKING YOUR OWN HOME FURNISHINGS — DI BERNARDO

D. VAN NOSTRAND CO., Inc.
250 Fourth Avenue New York 3, N. Y.

APPALACHIAN HARDWOOD LUMBER

Now Available:

FOR SCHOOL SHOPS

Hardwood Corporation of America, manufacturers of Appalachian Hardwood Lumber and Hardwood products announce the opening of an "Educational Lumber Division" to serve Industrial Arts and Vocational classes with the highest quality of thoroughly kiln-dried "Soft-Textured" Hardwood Lumber.

Personnel of the "Educational Lumber Division" have many years experience in Hardwood Lumber, Sales and Service to Educational Institutions.

If your purchases are made on inquiry or sealed bids, mail us your specifications, we will be pleased to submit a formal quotation.

Every Specie of American Hardwood used in School Shops!

●

KILN-DRIED "SOFT-TEXTURE"

●

Catalog

Showing delivered prices to most States east of the Mississippi River . . . . .

Now ready . . . Write for your free copy today . . .

HARDWOOD *Corporation of America*

EDUCATIONAL LUMBER DIVISION
ASHEVILLE, NORTH CAROLINA

Filling a definite need in Industrial Education, this new, informal book deals with the contributions of these nine distinguished leaders: Calvin M. Woodward, Lorenzo D. Harvey, Charles R. Richards, James H. Stout, Frederick G. Bonser, William E. Roberts, Ira S. Griffith, Ferdinand T. Struck, and John D. Runkle.

". . . intensely interesting reading . . . leaves the reader with an impression of having personally met each of the men dealt with . . . will cause any teacher of industrial education to feel a surge of pride in his calling because of the company to which he belongs. . . ."— *Arthur B. Mays.*

LEADERS in INDUSTRIAL EDUCATION

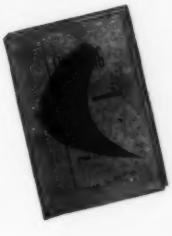
By William T. Bawden, Ph.D.

Cloth, 206 pages, $3.00

Order a copy for 5 days' free examination.

THE BRUCE PUBLISHING COMPANY
703 Bruce Building Milwaukee 1, Wis.

McKnight Publications



"FINISHINGS MATERIALS and METHODS"

By George A. Soderberg

1952 EDITION. This is the first complete book published on finishing in many years. It discusses up-to-date materials and processes, safety and health hazards. 26 "how to" units give easy-to-follow instructions on wood surfaces, metal finishes, flock, dry wall construction finishes and numerous other recent developments. 320 pages with 189 illustrations, cloth bound.

$4.00

McKNIGHT McKNIGHT PUBLISHING COMPANY
Dept. 83A, Market & Center Streets, Bloomington, Ill.

NEW PUBLICATIONS

(Continued from page 80A)

Alcoa — An American Enterprise

By Charles C. Carr. Cloth, 292 pp., 6 by 9½ in., illus., $3.50. Rinehart & Co., Inc., New York City.

An interesting history of the development of this astounding metal, the main personages involved in the stupendous growth of the aluminum industry, the legal and mechanical troubles which involved the growing industry, and the excellent services which it rendered during World Wars I and II.

Principles of Radio

By Keith Henney and Glen A. Richardson. Cloth, 655 pp., 5¾ by 8⅝ in., $5.50. John Wiley & Sons, Inc., New York 16, N. Y.

This is the sixth edition and is quite largely rewritten.

The book contains numerous practical problems, many of which are worked out in detail so that the student can see clearly how the solutions were arrived at.

The book also contains a chapter on electronic test equipment, and many tables found useful in the servicing of radios.

SAFETY — FACTS AND SUGGESTIONS

Practically every community is missing an important bet by not assuring that its industrial safety men become intimately acquainted with the school shops. Were I at the head of industrial education, I would be rather persistent in my invitations to safety men to look over my shops and help us to make them the best possible.

I would ask them to compare my facilities and practices to theirs — and to help me to eradicate any deficiencies they find. After all, the students I train will visit their gates looking for jobs.

Somehow or other I would find a way to get my instructors inside the industrial plants of my community. Not just once but often enough that our machine shop classes would hear frequently "This is the way XYZ company does it — but over at CBQ they do so and so." Maybe our teachers and the industrial safety fellows could meet together several times a year to our mutual advantage. . . . — *Dewey F. Barich.*

★ ★ ★ ★

In 1950, there were about four passenger cars for every commercial vehicle on the nation's streets and highways. The average commercial car, however, traveled nearly four times as far as the average pleasure car.

After balancing these two factors, you might assume since the total mileage is roughly the same for each group that pleasure cars and trucks are involved in about the same number of accidents.

But look at the record. There were 32,140 passenger cars involved in fatal accidents last year — and only 9,320 commercial cars. In the non-fatal column, the disparity is even wider.

The difference is not the vehicle. It is the driver.

The truck driver is a professional, with a professional's training and experience. He knows traffic laws and obeys them.

There are many exceptions, of course. But the exceptions are becoming harder and harder to find. For the third straight year, the percentage of commercial cars involved in accidents has dropped. — *The Travelers Insurance Co.*

★ ★ ★ ★

Among specific causes of deaths and injuries, excessive speed once again raised its record. "Speed took 13,300 lives last year. Speed caused 475,500 injuries last year. Speed was the dreadful mistake made by one of every three drivers involved in last year's serious accidents."

New and Important Books for

Vocational Training

GENERAL METALS — Feirer

GENERAL WOODWORKING — Groneman

MECHANICAL DRAWING, 5th Edition
French and Svensen

PROBLEMS IN MECHANICAL DRAWING
First Course and Second Course
Levens and Edstrom

AUTOMOTIVE MECHANICS, 2nd Edition
Crouse

5 AUTOMOTIVE MECHANICS WORKBOOKS
Crouse

MACHINE SHOP MATHEMATICS, 2nd Edition
Axelrod

REPAIRING AND CONSTRUCTING FARM BUILDINGS — Wooley

McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street New York 36, N. Y.

SELECTED **INDUSTRIAL ARTS TEXTBOOKS**

FOR YOUR REVIEW

Wilber
INDUSTRIAL ARTS IN GENERAL EDUCATION
362 pages, illustrated, $4.00

Newkirk and Zutter
CRAFTS FOR EVERYONE
216 pages, illustrated, $3.50

Marinaccio and Osburn
EXPLORING THE GRAPHIC ARTS
288 pages, illustrated, $3.00

Osburn and Wilber
PEWTER — SPUN, WROUGHT AND CAST
151 pages, illustrated, $3.00

Gallinger
THE JOY OF HAND WEAVING
316 pages, illustrated, $4.75

Klenke and Hayes
ELEMENTARY MECHANICAL DRAWING
250 pages, illustrated, $2.00

Klenke and Hayes
ADVANCED MECHANICAL DRAWING
316 pages, illustrated, $2.50

Send for EXAMINATION COPIES NOW!

INTERNATIONAL TEXTBOOK COMPANY
Dept. 651, SCRANTON 9, PENNSYLVANIA
Send for 1952 School Textbook Catalog

YOUR SCHOOL CAN AFFORD THIS QUALITY PORTABLE SYSTEM

Here's the versatile, sensibly-priced 30 Watt Sound System ideal for all school P.A. needs. Covers up to 4,000 persons indoors. Full 30 watts usable output; 3 inputs—two for high-impedance microphones, one for phonograph, each with separate volume control; with tone control; exceptional fidelity, ± 2db from 40-20,000 cps on phono and mike. Complete System includes: 30 watt amplifier and tubes, Electro-Voice "Cardax" unidirectional microphone with adjustable stand and 20' cable; two General Electric 12" PM speakers, each with 30' cable; portable carrying case, 16¾ x 12¾ x 25". For 110-130 volts, 60 cycle AC. Shpg. wt., 75 lbs. Ready for immediate delivery.

93-372. Complete 30-Watt System (less phono top). *Only* **$119.75**
93-340. 3-Speed Phono Top for above system. *Only* **$16.95**

SEND FOR FREE 212-PAGE CATALOG

Write today for the only *complete* Buying Guide to everything in Sound, Radio and Television for the school. Count on ALLIED for expert electronic supply service and for lowest, money-saving prices. Send today for your FREE copy of the complete 1952 ALLIED Catalog.

ALLIED RADIO
833 W. Jackson Blvd. • Dept. 51-C-2
Chicago 7, Illinois

ENVELOPES . . . FOR

PHOTO MAILING

DIRECT MAIL

PACKAGING MACHINE PARTS

CATALOGS and PRICE LISTS

MAILING MAGAZINES

FILING

For inexpensive packaging . . . special mailing problems . . . filing or storing . . . standard sizes . . . layout and design — whatever the job . . . whatever the problem . . . it will pay you to consult specialists. Call . . . write . . . or wire . . .

WESTERN STATES *Envelope Company*
Call . . . write . . . or wire . . .
3616 W. PIERCE STREET MILWAUKEE 46 WISCONSIN

They'll do a better job . . .

R. MURPHY
"Stay Sharp" Knives

KEEN, hand-honed blades of the finest tempered steel . . . hardened by an exclusive process . . . hold their edge longer — cut cleanly, easily.

"Proper Grip" handles are designed especially for each cutting job. That's why more and more instructors insist on Murphy *Stay Sharp* Knives . . . why *your* students will prefer them, too!

Special designs!

MANUAL TRAINING

SLOYD

STENCIL CUTTING

Also a full line of industrial knives.

Free catalog and price list. Write for yours *today!*

ROBERT MURPHY'S SONS CO.
GROTON RD. AYER, MASS.

Free TO INSTRUCTORS

HUNT'S BIG NEW WOODWORKERS CATALOG NO. 18

144 PAGES OF BARGAINS AT NEW LOW PRICES

Filled with greatest selection of--fine domestic and imported woods...mouldings...tools...machinery...cabinet hardware...fittings--at real money-saving prices.

Illustrates 32 rare and fancy woods, 54 multi-colored bandings, 40 inlays and overlays--in color. Also--31 embossed mouldings, 24 carved ornaments, 275 scroll patterns. And--51 pages of all kinds of tools and supplies plus pages of ideas, instructions, information. Save money, save time--send for your free copy NOW.

QUICK DELIVERY
One board or a carload
Maple, poplar, oak, mahogany, cherry, walnut, red cedar and many others--all properly seasoned and kiln dried and all correctly graded.

MAIL TODAY

CRAFTSMAN WOOD SERVICE CO.
2729 SOUTH MARY STREET, Dept. F-3
CHICAGO 8, ILLINOIS

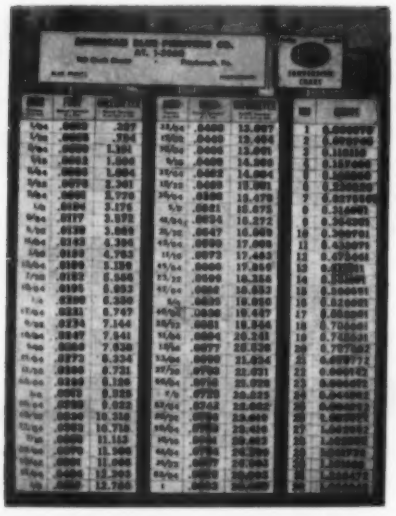
Please send me HUNT'S WOODWORKERS CATALOG No. 18--free to instructors. (Students 15c)

NAME.....
ADDRESS.....
CITY..... ZONE..... STATE.....

SHOP EQUIPMENT NEWS

POST CHART C — METRIC EQUIVALENTS

The Frederick Post Company has compiled a combination conversion and decimal equivalent chart. This chart converts inches to feet and metric equivalents all on one side. On the other side of this giant chart are the standard decimal equivalents.



Wall chart of metric equivalents

This chart is size 17 by 22 in., protected with tin at both top and bottom, and is ready for hanging.

The charts are free at dealers handling Post drafting materials, or write directly to *The Frederick Post Co., 3650 N. Avondale Ave., Chicago 18, Ill.*

For brief reference use IAVE — 0301.

NEW DOALL INSTRUMENT FOR MEASURING WITH MONOCHROMATIC LIGHT WAVES

The DoAll Company announces a new monochromatic light with 10 times the capacity of the previous model. The constant trend toward finer tolerances in size, flatness, and parallelism of production parts makes it necessary to use monochromatic light of greater intensity and size.

This new DoAll Monolight has all of the basic design features of the original model, shown at *A* in the accompanying illustration, such as its general rectangular, compact shape, its in-built power unit and adjustable-position helium light, which can be raised, lowered, and turned 360 deg., to suit any inspection job.

The new Monolight, shown at *B*, is a self-contained unit in a light, rigid, cast-aluminum body, having a 5 by 5½-in. high-intensity helium tube light source providing 53 foot-candle power on the testing stage. The standard stage is a 6⅛ by 4⅛-in. phenolic plate which can, at additional cost, be substituted by a granite surface plate lapped to within one wave band of true flatness.

New DoAll "Monolight" measuring instrument

Under the hinged work stage there is sufficient storage space for six 2-in. optical flats or three each 3-in. or 4-in. flats. Storage space is also provided to house the 5-ft. no-tangle extension cord.

The power supply is a 7500-volt transformer operating on 110–120 volt 60 cycle a.c.

The helium tube light source provides extremely accurate interference bands at .0000116-in. intervals, and when used with accurate optical flats, can be used to measure size, flatness, and parallelism to within a few millionths of an inch.

For additional specifications and information write the *DoAll Co., 254 North Laurel Ave., Des Plaines, Ill.*

For brief reference use IAVE — 0302.

WOODWORKING PLANS FOR THE HOME SHOP

The Atlas Press Company have just issued their Book One, Volume One, containing 20 Practical Woodworking Plans for the Home Shop.

This new book offers well-designed and tested-out plans to help the homecraftsman make twenty pieces of fine furniture that will grace any home.

For a copy of this book, which costs 50 cents, address *Atlas Press Co., Kalamazoo, Mich.*

For brief reference use IAVE — 0303.

THE BERKROY SHOP-ON-A-BENCH

Berkroy Products, Inc., have just issued a 6-page folder describing the Shop-On-A-Bench made of heavy gauge steel and equipped with five accurate and sturdy sheet-metal tools, such as the nibbler slitter, folder, brake, hand punch, shear and slip roll. The bench is 18 in. wide, 68 in. long, and 35 in. high.

The low cost of this equipment and the small space which it requires makes it ideal for the general shop.

The firm also makes a 24-in. ring and circle shear, and a 24-in. box and pan brake.

The tools described will handle up to 20-gauge sheet steel.

Berkroy can also furnish instructional material and working drawings for making a number of interesting sheet-metal projects.

For further information write to *Berkroy Products, Inc., 2516 N. Ontario St., Burbank, Calif.*

For brief reference use IAVE — 0304.

GBC MODEL 12 PLASTIC BINDING EQUIPMENT

The General Binding Corporation has recently introduced a low-cost portable plastic binding equipment designed especially for use in schools, libraries, and offices. This new compact equipment makes it possible for every school to do fast, economical plastic binding of books, loose papers, and printed or duplicated material of all sizes.

Compact GBC Model 12 plastic binding equipment

This equipment produces attractive booklets which open flat and stay flat. A major advantage of GBC plastic binding is the ease with which pages can be added or removed from bound booklets. Simply place the book on the binding machine . . . open the plastic binding. Insert the new sheets . . . close the binding.

For further information write to *General Binding Corp., 816 W. Belmont Ave., Chicago 14, Ill.*

For brief reference use IAVE — 0305.

DRAFTING ROOM-FILES AND DRAWER UNITS

The Engineering Manufacturing Company of Sheboygan, Wis., has developed a new line of plan files and drawer units. These units are made from selected and seasoned hardwood with a standard finish of golden oak. All parts are carefully machined, planed, and sanded. All corners and edges are rounded for utility and appearance.

These files and drawer units can be used with either a flush or a sanitary base. The top is removable, and stacking the units to any reasonable height can be readily accomplished.

The parts that are standard in these units are:

(Continued on page 88A)

This School Offers Major Advantages to Young Men Seeking

TECHNICAL TRAINING

Here the student receives both practical, specialized training in a field of his choice and a solid educational background in the basic sciences and humanities. Because of continuous year-round study, a Bachelor of Science Degree can be earned in 36 months.

For your reference in VOCATIONAL COUNSELING

Write for free 110-page catalog, Occupational Guidance Manual on

☐ Electrical Power
☐ Radio-TV
☐ Refrigeration, Heating and Air Conditioning
☐ Welding
☐ Scholarship data

COURSES

SERVICE 6–12 Months	TECHNICIAN 12–18 Months
• Electricity	• Radio-Television
• Welding	• Electronics
• Refrigeration	• Power
• Heating	• Welding
	• Air Conditioning

PROFESSIONAL — 36 Months
• Electrical Engineering — B.S. Degree. Major in Electronics or Power

MILWAUKEE SCHOOL OF ENGINEERING
Dept. IA-352, 1025 N. Broadway, Milwaukee, Wisconsin
A Technical Institute and College of Electrical Engineering

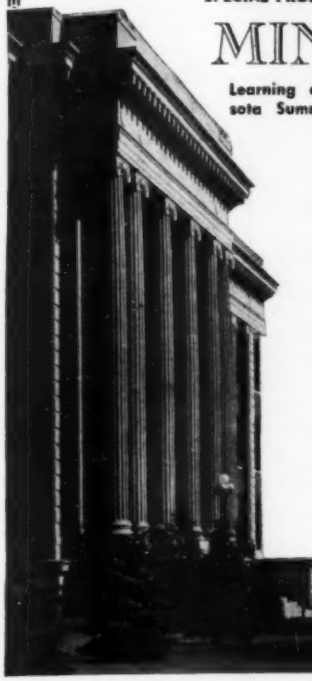
Summer Session

JUNE 16 to JULY 26 and JULY 28 to AUGUST 30

1200 REGULAR ACCREDITED SUBJECTS AND SPECIAL PROJECTS FROM WHICH TO CHOOSE AT

MINNESOTA

Learning and leisure go together at Minnesota Summer Session in the City of Lakes.



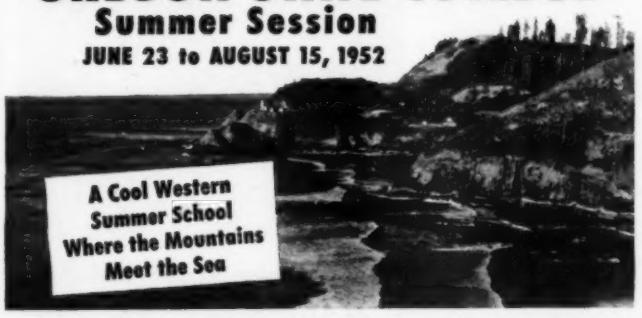
SPECIAL COURSES IN INDUSTRIAL EDUCATION. ALSO FEATURING PROJECTS IN . . .

- American Studies
- Printed Media
- Mass Media of Communication
- Language Arts
- Efficient Reading
- Modern Language Institute
- Renaissance Seminar
- Business History
- Intensive Beginning Greek
- Intensive Russian
- Scandinavian Studies
- High School Dramatic Workshop

Write Now For Helpful Bulletin!

Dean, Summer Session
UNIVERSITY OF MINNESOTA
757 JOHNSTON HALL
MINNEAPOLIS 14, MINN.

OREGON STATE COLLEGE
Summer Session
JUNE 23 to AUGUST 15, 1952



Formal study in scenic surroundings, with the Pacific beaches only two hours away and with week-end trips to the Cascade Mountains, Crater Lake, Oregon Caves, Cascade Lava Beds, and the Columbia River Highway.

Enjoy Graduate or Undergraduate Work under ideal climatic and professional conditions at a school widely recognized in the field of Industrial Arts Education, under a resident and visiting staff including outstanding national leaders in Industrial Arts.

Technical courses include all phases of shop work — Cabinet Making, Building Construction, Furniture Design, Boat Building, Sheet- and Art-metal Courses, Forging and Welding, General Metal Crafts, Machine Tool Practices, Metal Casting, Metal Spinning, Drafting and Design.

Professional courses include Driver Education and Training (AAA sponsorship and approval), Audio-Visual Subjects, Guidance and Counseling, Curriculum Workshop, Graduate Seminars, Shop Planning and Organization, Professional Symposiums.

The student may plan a program which will lead through successive summers to the bachelor's or master's degree. Approved programs carrying the recommendation of Oregon State College are accepted by all state departments of education for either a *Special* or a *General Secondary* Credential. Correspondence invited.

Address: Department of Industrial Education
OREGON STATE COLLEGE
CORVALLIS, OREGON
AUTHORIZED BY OREGON STATE BOARD OF HIGHER EDUCATION

SUMMER SESSION

SIX WEEKS SESSION
June 23 to August 1

FOUR WEEKS SESSION
August 4 to August 29

- Special rates for teachers in active service
- Living accommodations available on and near the campus
- Organized social and recreational program

Students may take work leading to undergraduate or graduate degrees, teachers' credentials, and other professional objectives. The departments of the College of Letters, Arts, and Sciences, and of the Graduate School will present a wide variety of courses. The schools of Architecture, Commerce, Dentistry, Education, Engineering, Journalism, Law, Library Science, Music, Pharmacy, Public Administration, Religion, Social Work, and the departments of Cinema, Occupational Therapy, Physical Therapy, and Telecommunications will provide courses for professional training.

SPECIAL OPPORTUNITIES

The regular faculty of the University will be augmented during the Summer Session by distinguished guest professors from American and European universities.

WRITE TO SUMMER SESSION DIRECTOR FOR BULLETIN
UNIVERSITY OF SOUTHERN CALIFORNIA
LOS ANGELES 7, CALIFORNIA

DELMAR ANNOUNCES...

Two New and Basic Blueprint Reading Texts!

JUST PUBLISHED!

BASIC BLUEPRINT READING and SHOP SKETCHING

by C. Thomas Olivo and Albert V. Payne

This new text covers fundamentals by (a) thoroughly explaining and illustrating each new principle, (b) applying this principle in an actual blueprint, and (c) testing for mastery with assignments based on each blueprint. Such unit organization assures complete coverage and aids individual instruction. *Recommended for all basic courses where instruction is required in metal trades blueprint reading.*

150 pages, 33 instructional units, 42 industrial blueprints $1.90

* * *

BLUEPRINT READING and SKETCHING-Building Trades

A joint development of the Connecticut State Education Department and Delmar Publishers, Inc.

This instruction material, tested and proven in actual use, is the basic text of a series which shall include advanced instruction for each specific area of this trade. It employs the unit pattern, is thorough in every detail, completely up-to-date and well-illustrated. Necessary tables, data, blueprints and assignments are included. The contents covers: Part I, Interpreting architectural drawings; Part II, Orthographic, isometric and oblique sketching; Part III, Reading trade blueprints.

200 pages, tables, folded-in blueprints $2.50

MAIL COUPON NOW . . . FOR 30 DAY FREE EXAMINATION

IA-23 Date.....

DELMAR PUBLISHERS, INC. Dept.
Albany 1, New York

SEND ME FOR 30-DAY EXAMINATION:

☐ Basic Blueprint Reading and Shop Sketching — Metal Trades

☐ Blueprint Reading and Sketching for the Building Trades

NAME.....

SCHOOL.....

ADDRESS.....

CITY.....ZONE.....STATE.....

SHOP EQUIPMENT NEWS

(Continued from page 86A)

a plain cap, the *A* drawer unit consisting of two tool drawers and one shallow drawer; the *B* drawer unit consisting of two tool drawers and three shallow drawers; the *C* drawer unit consisting of five shallow drawers; the *W* flush base, and the *X* low sanitary base. All units can be had for either 36- or 42-in. wide tables. Also, there is a standard length for the 60-in. table and a longer drawer length for tables longer than 60 in. All drawers ride on treated wood runners which insure smooth, easy action.

The former name of Engineering Sales Company has been changed to Engineering Manufacturing Company. The present officers of the company are E. H. May, president and treasurer; Mary May, vice-president and secretary; and Harold H. Mais, assistant secretary and treasurer.

For further information about the products of this firm, address *Engineering Mfg. Co., 619 North Commerce Street, Sheboygan, Wis.*

For brief reference use IAVE — 0306.

NEW HESTON AND ANDERSON JOINTER

Heston & Anderson Division of the St. Paul Foundry & Mfg. Co., announce their 1952 Model 6-in. Jointer. It has a narrower throat opening, a fence that may be set at an angle across the cutterhead for shearing cutting and for jointing short stock safely. The guard turns under the table when rabbetting wide stock and is immediately returned; no adjustments necessary. Table is 60 in. over all; rabbets 5/8 in., providing depth cutting often needed. Direct drive model now available.

Address *Heston & Anderson, Fairfield, Iowa,* for latest bulletin.

For brief reference use IAVE — 0307.

NEW SNAP-ON CATALOG

This new catalog of Snap-On and Blue-Point tools describes the successes achieved by the Snap-On Tools Corporation since it began making the first sets of interchangeable socket wrenches.

Besides describing and illustrating the many types of wrenches made by this firm, the catalog also pictures the Red Cap welded steel tool cabinets, the Snap-On all steel Rolla-Bench, Triple-Unit Tool Cabinet, all steel Mechanikit, Mechanics Chest, the Coaster Cab, Universal Midget Kit, the industrial Roll-Cab, and many tools used for maintenance and servicing.

Teachers of auto mechanics may obtain this catalog by writing to *Snap-On Tools Corp., 93 Piquette Ave., Detroit 2, Mich.*

For brief reference use IAVE — 0308.

NEW FOLDING MACHINE

A. B. Dick Company, manufacturers of A. B. Dick duplicating products, have announced the introduction of a new Model 56 Folding Machine.

The new, low-cost 56 Folder reduces the most commonly used folds, such as single folds, parallel letter folds, double parallel folds, accordion or statement folds, French folds, and horizontal with two vertical folds, to simple alphabetical settings.

Upper and lower fold plates bear precision scales clearly marked in inches to permit accurate plate settings for other types of folds.

(Continued on page 90A)

A Toolshop in Your Hand

HANDEE

tool of 1001 Uses

HANDEE is a basic "must" for every industrial arts class. It's the tool for really smooth, controlled power ...works in metal, wood, glass, bone, leather, etc. Internal carving in plastics. Grind, drill, carve, saw; other uses, too. Easy to instruct...easy to operate... students take to HANDEE readily! More HANDEE tools are in use today than all others combined!

First Tool of Its Kind
TODAY'S FINEST

SCHOOL SET

HANDEE and 51 matched accessories in sturdy, steel carrying case..... $27.50

HANDEE with 7 basic accessories ... $19.95

Available at better stores everywhere or direct from factory postpaid.

FREE! New 64-page Manual on request. Write today!

CHICAGO WHEEL & MFG. CO.

1101 West Monroe St., Dept. IAV, Chicago 7, Illinois

help make their *HANDS MORE CREATIVE* with x-acto Knives and Tools

X-acto precision knives and tools help give your students' hands more creative "follow-thru." Because there's a specific designed-for-the-job X-acto for many different school handicraft, art and shop needs . . . to help them do a better job—with their own hands. X-acto offers a complete line of unique tools, knives and interchangeable blades.

from 25¢ to $30.
at dealers everywhere.

x-acto®

Write today for our new illustrated 28-page Catalog.

X-acto Crescent Products Co., Inc.
440 Fourth Avenue, New York 16, New York

SCHOOL OF EDUCATION
NEW YORK UNIVERSITY
1952 Summer Session

INTERSESSION June 2-27, 1952
SUMMER SESSION June 30-Aug. 8, 1952
POSTSESSION Aug. 11-Sept. 5, 1952

Professional and Technical Courses in
VOCATIONAL EDUCATION
INDUSTRIAL ARTS EDUCATION — ARTS AND CRAFTS
OCCUPATIONAL THERAPY — AERONAUTICAL EDUCATION
VOCATIONAL REHABILITATION
GRADUATE and UNDERGRADUATE COURSES
leading to
DOCTOR'S, MASTER'S and BACCALAUREATE DEGREES
including NEW SIXTH YEAR PROGRAM

For information and complete Bulletins covering all sections and divisions, write to:
VOCATIONAL EDUCATION, DEPT. 1-A
SCHOOL OF EDUCATION
NEW YORK UNIVERSITY
Washington Square New York 3, N. Y.

THE PENNSYLVANIA STATE COLLEGE
Department of
INDUSTRIAL EDUCATION

1952 Summer Session
Inter-Session — June 10–27
Main Session — June 30–Aug. 9
Post Session — August 11–29

Vocational Industrial
and
Industrial Arts Education
Doctors, Masters and Baccalaureate Degrees

Separate graduate and undergraduate curricula in vocational industrial and in industrial arts education for in-service teachers, supervisors, administrators, and other qualified individuals. Short unit courses dealing with national, state and local problems.

For further information and catalog address:
Director of Summer Sessions
Room 102, Burrowes Building

THE PENNSYLVANIA STATE COLLEGE
State College, Pennsylvania

COURSES IN **INDUSTRIAL ARTS AND VOCATIONAL EDUCATION**
In Cool-Colorful Colorado

AT A SCHOOL RECOGNIZED AS A LEADER IN THE FIELD!

TWO FOUR WEEK TERMS
- June 23 — July 18
- July 21 — August 15

Undergraduate & Graduate Courses

Other programs leading to the master's degree in *Guidance and Counseling, Home Economics,* and *Physical Education for Men.* Courses in Conservation Education, Education and Psychology.

Summer activities for all students and their families; trips to Central City and Cheyenne Frontier Days, hikes, sight-seeing trips, picnics, dances and parties.

COMBINE A "VACATION AND A PRACTICAL EDUCATION AT A MILE HIGH LEVEL"

Address Correspondence to Registrar
COLORADO A&M COLLEGE
FORT COLLINS

BENNETT COLLEGE
BRADLEY UNIVERSITY
1952 Summer Session — Two 30-Day Terms
June 11 to July 17 • July 17 to August 21

- Programs pertaining to industry and industrial teacher training.
- Balanced technical and professional course offerings.
- Four short term courses by nationally known guest professors.
- Variety of courses by resident faculty.
- Six semester credits each term.
- Bachelor's, Master's, and Doctor's Degrees in Industrial Education.

FOR FURTHER INFORMATION AND BULLETINS WRITE TO:
Dean of Bennett College
or
Director of the Summer Session
BRADLEY UNIVERSITY
Peoria 5, Illinois

VENUS

preferred by professionals for perfect pencil rendering!

LOOK FOR THE GREEN CRACKLED FINISH

VENUS

the world's largest selling

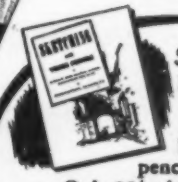
DRAWING PENCILS

They're ACCURATELY GRADED —for perfect tonal values

They're STRONG —the lead is Pressure-Proofed*

They're SMOOTH —the lead is Colloidal* processed

*Exclusive Venus patent



Send for helpful, illustrated instruction brochure on pencil sketching. Only 25¢ with *two* FREE Venus Drawing Pencils.

American Lead Pencil Co., Hoboken, N. J.
—makers of famous Venus Hooded Pens

American Lead Pencil Co.
Hoboken, N. J. Dept. IAVE 3-52

Enclosed is 25¢ for "Sketching with Venus." Please include my free Venus Drawing Pencils. *Specify degrees:* ( ) ( ).

Name .....

Street .....

City ..... State .....

SHOP EQUIPMENT NEWS

(Continued from page 88A)

A simple angular adjustment compensates for paper that is not squarely cut.

The Model 56 Folder folds paper stock in weights from 16 to 36 substance in sizes ranging from 2½ to 9 in. in width, and 3½ to 14 in. in length. Uninterrupted folding may be accomplished by loading the folder while it is in operation.

Further information may be obtained from *A. B. Dick Co., 5700 West Touhy Ave., Chicago 31, Ill.*

For brief reference use IAVE — 0309.

WESTINGHOUSE SCHOOL-LIGHTING BOOKLET

A revised 20-page ABC Plan School-Lighting booklet is now available from the Westinghouse Electric Corporation.

The booklet outlines six basic points that should be considered before buying a lighting system and applies these points to several problems typical to most schools. Complete data and sketches are provided for eight sample lighting layouts, and photographs and descriptions of seven types of luminaires are included.

For a copy of booklet B-4556-A, write to *Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.*

For brief reference use IAVE — 0310.

PENCIL TRACING CLOTH WITH COMPANION LIQUID ERASER

For the first time draftsmen are offered a pencil tracing cloth with new qualities permitting the use of a liquid eradicator to remove large pencil areas cleanly, quickly, and without disturbing the tooth of the original cloth.

Whitex Smooth is white in color, and the surface produces sharp, jet black detail from a 2H pencil. Good prints are assured by the extreme translucency providing a maximum contrast between pencil and the white background.

Write for free special demonstration kit. Send your request to *The Frederick Post Co., 3560 N. Avondale Ave., Chicago 18, Ill.*

For brief reference use IAVE — 0311.

A FINISHING MANUAL

A new handy pocket-size finishing manual is now available.

It covers all forms of wood finishing by the Sealacell Process. It contains complete information on wood blonding and many other novelty finishes as well. Sample copies are free upon request, and additional student copies are free with orders for materials.

Write to the *General Finishes Sales & Service Co., 1548 W. Bruce St., Milwaukee 4, Wis.*

For brief reference use IAVE — 0312.

CATALOGUE ON LEVELS

A condensed catalogue showing all items in its Stevens level line is announced by the Stevens Level Division, Columbian Vise & Mfg. Co., Cleveland, Ohio.

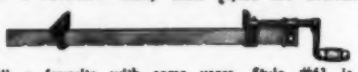
A new catalogue feature is the inclusion of handy reference tables for easy ordering of carpenters' and masons' levels. Listed separately in

(Continued on page 92A)

SPECIFY AND INSIST UPON GENUINE "Jorgensen" TRADE MARK REG U S PAT OFF

STEEL BAR CLAMPS

"JORGENSEN" Steel Bar Clamps offer many exclusive desirable features. The "multiple disc clutch" holds securely, releases easily without notches or other deformity in the bar. Fast operating and economical — repairs easily made if ever necessary. Built to industrial standards, they will serve you best in the school shop. Style #70 "JORGENSEN" I-bar Clamps are a favorite — many other styles are available.



Still a favorite with some users, Style #61 is a "notched bar" type steel bar clamp. Somewhat slower in operation than our "fast-operating" bar clamps, but just as carefully designed. Will provide long, satisfactory service.

"JORGENSEN" Handscrews are regarded as the "standard" everywhere for school-shop and industrial service. Jaws are carefully selected, properly seasoned hard maple, made in our own factory; cold-drawn steel spindles; hard maple handles will not come loose. Look for the trade-mark "JORGENSEN" on every jaw.

"Jorgensen" AND "Pony"

Steel Bar Clamps, "C" Clamps, Handscrews, Clamp Fixtures, Press Screws, Lathe Dogs, etc., are available thru your favorite tool supplier — cost no more than ordinary clamps!

CATALOG SENT FREE UPON REQUEST

ADJUSTABLE CLAMP COMPANY
"The Clamp Folks"
424 No. Ashland Ave. Chicago 22, Ill.

Teach
Modern Wood Finishing
with the famous
SEALACELL PROCESS
The Wipe-on" Finish that
- Eliminates dust troubles
- Requires no brushes
- Protects and preserves wood
- Needs no sanding between coats

SPECIAL OFFER
Our new pocket size Sealacell Penetrating Process Wood Finishing Manual is free on request. Additional student copies sent free with your order of materials.

GENERAL FINISHES SALES and SERVICE CO.
1548 West Bruce St. Milwaukee 46, Wis.

DIRECTORY OF MANUFACTURERS' PRODUCTS

This directory is published as a convenient guide to sources of supply, covering the products of manufacturers carrying product information in this ANNUAL NUMBER. For alphabetical index of manufacturers' advertising see page 101A. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division, or use coupon on page 102A.

A

ADJUSTABLE CURVE RULERS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick

AMMETERS
General Electric Co.
Weston Electric Instrument Corp.

ANVILS
Atlas Press Co.
Cincinnati Tool Co.

ANVIL TOOLS
Stanley Tools

ARBOR PRESSES
Atlas Press Co.

ARC-WELDING SETS & EQUIP.
Delta Mfg. Co.
General Electric Co.
Marquette Mfg. Co.

ARCHERY MATERIALS
Indianhead Archery & Mfg. Co.

ART METAL TOOLS
Metal Crafts Supply Co.

AUTOMOTIVE TOOLS AND EQUIPMENT
Armstrong Brothers Tool Co.
Black & Decker Mfg. Co.
Blackhawk Mfg. Co.
Crescent Tool Co.
Curtis Pneumatic Mach. Div.
Millers Falls Co.
Proto Tools
Snap-On Tools, Inc.
Stanley Tools
Starrett Co., L. S.
Utica Drop Forge & Tool Corp.

AWLS, TINNERS
Millers Falls Co.
Stanley Tools

AXES
Plumb, Inc., Fayette R.

B

BABBITT FURNACES
American Gas Furnace Co.
Johnson Gas Appliance Co.

BABBITT METAL
Kester Solder Co.

BAND SAW BLADES
Atkins & Co., E. C.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Duro Metal Products Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.

BAND SAW BRAZERS, Electric
Atkins & Co., E. C.
Oliver Machinery Co.

BAND SAWS
Atkins & Co., E. C.
Boice Crane Company
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Corp.
Disston & Son, Inc., Henry
Do All Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Shopmaster, Inc.
Starrett Co., L. S.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

BAND SAWS, METALCUTTING
Kalamazoo Tank & Silo Co.
Starrett Co., L. S.

BAND SAWS, PORTABLE
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.
Wallace & Co., J. D.

BAND SAW SETS
Atkins & Co., E. C.

BATTERY CHARGERS
General Electric Co.

BENCH FURNACES
American Gas Furnace Co.
Johnson Gas Appliance Co.

BENCH VISES
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Desmond-Stephan Mfg. Co.
Millers Falls Co.
Morgan Vise Co.
Oliver Machinery Co.

BENCHES Jewelers' and Metal Workers'
Sjostrom Co., John E.

BENCHES, MANUAL TRAINING
Brodhead-Garrett Co
Hamilton Manufacturing Co.
Sjostrom Co., John E.

BINDERY EQUIPMENT & SUPPLIES
Pratt, G. A.

BIT HOLDERS, EXTENSION
Greenlee Tool Co.
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

BITS, AUGER
Stanley Tools

BITS, SCREW DRIVERS
Greenlee Tool Co.
Millers Falls Co.
North Brothers Mfg. Co.
Snap-On Tools, Inc.
Stanley Tools

BLACKBOARD DRAWING SETS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Weber Co., F.

BLACKSMITH TOOLS AND SUPPLIES
Columbian Vise & Mfg. Co.

BLOWERS, FORGE
American Gas Furnace Co.

BLOWPIPES, Brazing, Jewelers'
American Gas Furnace Co.

BLUE-PRINTING MACHINES, ELECTRIC
Dietzgen Co., Eugene
Post Company, Frederick

BOARDS, DRAWING
Dietzgen Co., Eugene
Engineering Sales Co.
Hamilton Mfg. Co.
Post Company, Frederick
Weber Co., F.

BOATS — PLANS & INSTRUCTIONS
Dillabaugh Co., C. R.

BOOKBINDERS SUPPLIES
American Type Founders Sales Corp.
Pratt, G. A.

BOOKS
American Technical Society
Bennett Co., Chas. A.
Bergling, V. C.
Bruce Publishing Company
Delmar Publishers
International Textbook Co.
Macmillan Co., The
McGraw-Hill Book Co.
McKnight & McKnight
Rider Publisher, Inc., John F.
Van Nostrand Co., D.

BORERS, WOOD
Delta Mfg. Co.
De Walt Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Wallace & Co., J. D.
Yates-American Machine Co.

BORING BARS
Armstrong Bros. Tool Co.
Atlas Press Co.
Cincinnati Lathe & Tool Co.
South Bend Lathe Works
Williams & Co., J. H.

BORING TOOLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Williams & Co., J. H.

BOW COMPASSES, DIVIDERS, PENS, PENCILS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
V. & E. Mfg. Company
Weber Co., F.

BRACES
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

BRAD AWLS
Millers Falls Co.
Stanley Tools

BRASS FURNACES, GAS
American Gas Furnace Co.
Johnson Gas Appliance Co.

BRASS TYPE
American Type Founders Sales Corp.

BRAYERS
American Type Founders Sales Corp.

BRAZING TORCHES
American Gas Furnace Co.
Atkins & Co., E. C.

BRISTOL BOARD
Dietzgen Co., Eugene
Post Company, Frederick
Weber Co., F.

BRITTANIA METAL
Metal Crafts Supply Co.

BRUSHES, ARTISTS'
Dietzgen Co., Eugene
Post Company, Frederick

BRUSHES, CIRCULAR, BRISTLE AND WIRE (All Kinds)
Atlas Press Co.

BUFFERS, BENCH, PEDESTAL
Black & Decker Mfg. Co.
Delta Mfg. Co.
Snap-On Tools, Inc.
Stanley Electric Tools

BUSES
Ford Motor Co.

C

CABINET HARDWARE
Brodhead-Garrett Co.
Stanley Works
Upholstery Supply Co.

CABINETS, Cut and Electro
American Type Founders Sales Corp.
Hamilton Mfg. Co.

CABINETS, Furniture, Galleys, Ink, Type, and Rollers
American Type Founders Sales Corp.
Hamilton Mfg. Co.

CALIPERS
Starrett Co., L. S.

CARVING TOOLS for Wood and Linoleum
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
Greenlee Tool Co.

CENTER LATHE
Atlas Press Co.
Cincinnati Lathe & Tool Co.
LeBlond Machine Tool Co.
South Bend Lathe Works

CERAMICS, SUPPLIES
American Art Clay Co.
Brodhead-Garrett Co.
Electric Hotpack Company, Inc.
Seeley's Ceramic Studio
Weldon Laboratory, James W.

CHARTS
Disston & Sons, Henry
Nicholson File
Stanley Tools

CHASES
American Type Founders Sales Corp.

CHASING TOOLS
Metal Crafts Supply Co.

CHISELS, Cape, Cold, Grooving
Atlas Press Co.
Cincinnati Tool Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Millers Falls Co.
Proto Tools
Stanley Tools

CHISELS, FRAMING, MORTISE
Greenlee Tool Co.
Millers Falls Co.
Proto Tools
Stanley Tools

CHISELS, Metal Cutting and Wood Carving
Atlas Press Co.
Crescent Tool Co.
Disston & Sons, Inc., Henry
Duro Metal Products Co.
Greenlee Tool Co.
Millers Falls Co.
Proto Tools
Stanley Tools

CHUCKS, COMBINATION
Atlas Press Co.
Cincinnati Lathe & Tool Co.
Snap-On Tools, Inc.
South Bend Lathe Works

CHUCKS, DRILL
Atlas Press Co.
Cincinnati Lathe & Tool Co.
Duro Metal Products Co.
South Bend Lathe Works
Walker-Turner Co., Inc.

CHUCKS, INDEPENDENT, Universal Combination
Atlas Press Co.
Boice Crane Company
Cincinnati Lathe & Tool Co.
Duro Metal Products Co.
South Bend Lathe Works
Walker-Turner Co., Inc.

CIRCULAR-SAW BENCHES
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Shopmaster, Inc.
Shopsmith
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

CIRCULAR SAWS
P.T.I., Inc.

CLAMPS
Adjustable Clamp Co.
Armstrong Bros. Tool Co.
Atkins & Co., E. C.
Cincinnati Tool Co.
Starrett Co., L. S.

CLAMPS, ADJUSTABLE
Adjustable Clamp Co.
Cincinnati Tool Co.

CLAMPS, BAR
Adjustable Clamp Co.
Cincinnati Tool Co.
Oliver Machinery Co.

CLAMPS, CARRIAGE, SCREW
Adjustable Clamp Co.
Cincinnati Tool Co.
Oliver Machinery Co.

COMBINATION SQUARES
Starrett Co., L. S.

COMPOSING STICKS
American Type Founders Sales Corp.
Rouse & Co., H. B.

CONDUITS
General Electric Co.

CONTROLLERS, ELECTRIC
General Electric Co.

COPING SAW BLADES
Atkins & Co., E. C.
Delta Mfg. Co.
Disston & Sons, Inc., Henry

TO DO JOBS BETTER AND FASTER
there's
Nothing like a
PLUMB
QUALITY COMES FIRST
PLUMB IS FIRST IN QUALITY
The red handle with the black head exclusively PLUMB
As soon as you see it you'll know it's a Plumb hammer. Fast, easy-swinging strokes strike hard and accurately. Its balance lessens fatigue—let's you do more without tiring.
First choice among men who use hand tools in their daily tasks, the Plumb hammer is engineered to do better work faster. The springy comfort-grip hickory handle absorbs shocks. The head is constructed of special analysis steel hardened at four separate points. There's no substitute for Plumb quality, one reason why wise dealers won't offer you something "just as good."
Get a Plumb hammer—you'll do more in less time.
HAMMERS
HATCHETS
AXES
FILES
PLUMB

Tandy Offers Special Discounts to Schools and Institutions.

SHOP EQUIPMENT NEWS

(Continued from page 90A)

the two tables are clear California sugar pine and mahogany levels, with sizes tabulated from 24 to 48 in. of standard, brass bound and brass end design.

Stevens line levels, machinists' levels, pocket levels, aluminum and torpedo levels are also described in the new catalogue. Copies may be obtained by writing *The Columbian Vise & Mfg. Co., 9023 Bessemer Avenue, Cleveland 4, Ohio.*

For brief reference use IAVE — 0313.

WALKER-TURNER STUDENT PLAN SHEETS

A student plan sheet is another of the services being made available for industrial-arts teachers by the Walker-Turner Division of Plainfield, N. J.

This sheet is designed with the comprehensive general shop in mind but can also be used in the general unit or unit type of shop.

It contains all of the elements for successful planning — recognition of industrial division; billing of material; schedule of finishes; related information; time and operational planning; inspection points and evaluation on a personal efficiency basis. The sheet is punched for notebook use and provides a source in itself for cost study, inventory records, and other statistical data.

These sheets can be obtained from the *Education Department, Walker-Turner Division, Kearney & Trecker Corp., Plainfield, N. J.*, at a very nominal cost, 50 cents per hundred.

For brief reference use IAVE — 0314.

NEW AMACO METAL ENAMELS

Amaco Metal Enamels — 21 opaque and 6 transparent — are the newest addition to the line of Amaco ceramic supplies. During this past summer, instruction in metal enameling was offered for the first time in the Amaco Ceramic Workshops. Teachers from 12 states attended the four two-week workshops, and almost all of them wished some instruction in metal enameling.

For complete details concerning the new Amaco Metal Enamels write *American Art Clay Company, Ceramic Division, 4717 West Sixteenth St., Indianapolis 24, Ind.*

For brief reference use IAVE — 0315.

NEW JOHNSON CATALOG

A new catalog, No. 51, which illustrates and describes the Johnson line of burners, and furnaces for hardening, tempering, and annealing, valves, torches, mixers, and blowers, has just been issued by the Johnson Gas Appliance Company.

This catalog may be obtained by writing the manufacturer, *Johnson Gas Appliance Company, Cedar Rapids, Iowa.*

For brief reference use IAVE — 0316.

NEW BLACK AND DECKER SALES AND SERVICE BRANCH

The new Sales and Service Branch of the Black & Decker Mfg. Co., at 2432 South Broadway in Los Angeles 7, Calif., was opened the first week in January, 1952.

It features the latest facilities and conveniences for the customers of Black & Decker, including

(Continued on page 94A)

POWER DRIVEN VARIABLE SPEED POTTER'S WHEEL

Here are professional features never before available at such a popular price. Versatile enough for the most advanced craftsman, yet simple enough for beginners' use. Precision built for smooth, long-lived performance. Compact, portable, mounts anywhere. Ideal for schools and home ceramic studios.

FEATURES NEVER BEFORE OFFERED AT SO LOW A PRICE
DESIGNED FOR SCHOOL USE
ONLY $57.50

New variable speed reducer with adjustable foot control provides speed range from 38 to 130 RPM. Other features include built-in water container, attached wedging wire, reversible 9 inch throwing head with recess for molding plaster bats. Order by mail now . . . or write for complete literature.

B & I MANUFACTURING CO.
Dept. A3 Burlington, Wis.

Just Out!
Catalog "J"
1000 AND MORE— INDISPENSABLE ITEMS FOR THE WOOD SHOP
160 PAGES
CABINET HARDWARE
SPECIAL FINISHING SUPPLIES
MECHANICS HAND TOOLS
POWER HAND TOOLS
UPHOLSTERY SUPPLIES
Send For Your Free Copy Today
THE UPHOLSTERY SUPPLY CO.
1033 N. 4th Street Milwaukee 3, Wis.

COPING SAWS
Atkins & Co., E. C.

COPING SAWS, Power
Delta Mfg. Co.
Duro Metal Products Corp.
Walker-Turner Co., Inc.

COUNTERSINKS
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

CURVES, IRREGULAR
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Weber Company, F.

CUT-OFF SAWS
Atkins & Co., E. C.
Delta Mfg. Co.
De Walt Products Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Wallace & Co., J. D.
Yates-American Machine Co.

CUTTER HEADS
Atkins & Co., E. C.
Delta Mfg. Co.
Williams & Co., J. H.
Yates-American Machine Co.

CUTTER & TOOL GRINDERS
Cincinnati Milling Mach. Co.
Le Blond Mach. & Tool Co.,R. K.

CYLINDER PRINTING PRESS
American Type Founders Sales Corp.

D

DADO HEADS
Atkins & Co., E. C.
Boice Crane Company
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Duro Metal Products Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Walker Turner Co., Inc.
Yates-American Machine Co.

DISTRIBUTION TRANSFORMERS
General Electric Co.

DOWEL POINTERS
Stanley Tools

DOWELING JIGS
Stanley Tools

DRAFTING PENS
Alvin Company
Berger Scientific Supplies, Inc.
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
U. S. Blue Print Paper Co.

DRAFTING TABLES
Dietzgen Co., Eugene
Engineering Sales Co.
Hamilton Mfg. Co.
Post Company, Frederick
Sjostrom Co., John E.
V. & E. Mfg. Company
Weber Company, F.

DRAFTSMEN'S INSTRUMENTS
Alvin Company
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Starrett Co., L. S.
U. S. Blue Print Paper Co.
V. & E. Mfg. Company
Weber Company, F.

DRAWING INSTRUMENT REPAIR PARTS
Dietzgen Co., Eugene
Engineering Sales Co.

DRAWING OUTFITS
Alvin Company
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
U. S. Blue Print Paper Co.
V. & E. Mfg. Company
Weber Company, F.

DRAWING PAPER IN ROLLS AND SHEETS
Dietzgen Co., Eugene
Post Company, Frederick
U. S. Blue Print Paper Co.
Weber Company, F.

DRILL PRESSES
Atlas Press Co.
Boice Crane Company
Brodhead-Garrett Co.
Cincinnati Lathe & Tool Co.
Delta Mfg. Co.
Duro Metal Products Co.
Millers Falls Co.
Rockford Machine Tool Co.
Shopmaster, Inc.
South Bend Lathe Works
Walker-Turner Co., Inc.

DRILL SHARPENERS
Atlas Press Co.

DRILL STANDS, BENCH, POST, PEDESTAL
Armstrong Bros. Tool Co.
Black & Decker Mfg. Co.
Boice Crane Company
Brodhead-Garrett Co.
Duro Metal Products Co.
Millers Falls Co.
Rockford Machine Tool Co.
Shopsmith
Stanley Electric Tools

DRILLING MACHINES, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
Dumore Company, The
Millers Falls Co.
Rockford Machine Tool Co.
Sibley Machine & Fdry. Corp.
Snap-On Tools, Inc.
Stanley Electric Tools
Stanley Tools

DRILLING MACHINES, RADIAL
Cincinnati Lathe & Tool Co.

DRILLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Crescent Tool Co.
Greenlee Tool Co.
Snap-On Tools, Inc.

DRILLS, BENCH AND FLOOR, HIGH SPEED
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
Millers Falls Co.
Rockford Machine Tool Co.
Walker-Turner Co.

DRILLS, BREAST
Millers Falls Co.
Stanley Tools

DRILLS, CARVING FOR PLASTICS
Elbar Products

DRILLS, HAND
Chicago Wheel & Mfg. Co.
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

DUPLICATORS
Dick Co., A. B.

DYNOMETERS, ELECTRIC
General Electric Co.

E

ELECTRIC WELDING EQUIPMENT & SUPPLIES
Delta Mfg. Co.
General Electric Co.
Marquette Mfg. Co.

ELECTRIC EQUIPMENT, WIRE & SUPPLIES
Gearon Company, The
Gyro Lamp and Shade Corp.

ELECTRIC GENERATORS
General Electric Co.

ELECTRIC MOTORS
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
General Electric Co.
Walker-Turner Co., Inc.

ELECTRONIC EDUCATOR
Durnville, S. H.

ELECTRIC SOLDERING IRONS
Stanley Tools

ELECTRICAL INSTRUMENTS
General Electric Co.
Weston Electric Instrument Co.

ELECTROTYPES
Badger-American Electrotype Co.

ENGRAVERS' TOOLS AND SUPPLIES
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
Metal Craft Supply Co.

ENVELOPES, Report Card, Commercial, Clasp, Baronial, Catalog
Western States Envelope Co.

EXPOSURE METERS
General Electric Co.
Weston Electric Instrument Corp.

F

FEEDERS, Automatic (Printing)
American Type Founders Sales Corp.

FILES AND RASPS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Nicholson File Co.
Plumb, Inc., Fayette R.

FILING CASES
Dietzgen Co., Eugene
Hamilton Mfg. Co.
Post Company, Frederick
Weber Company, F.

FILING MACHINES
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Foley Mfg. Co.

FILMS, INDUST. TRAINING
Eastman Kodak Co.

FILMS, TEACHING, ETC.
Crescent Tool Co.
Utica Drop Forge & Tool Corp.

FINISHING MATERIALS
General Finishes Sales & Service Co.
Upholstery Supply Co.

FIRE BRICK AND CEMENT
Sunbeam Corp.

FIRE CLAY
Sunbeam Corp.

FISHING TACKLE PROJECTS
Empire Tackle Co.

FLASKS
Sterling Wheelbarrow Co.

FLEXIBLE SHAFT AND MOTOR OUTFITS
Duro Metal Products Co.
Foredom Electric Co.
Walker-Turner Co., Inc.

FLEXIBLE STEEL TAPE RULES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

FLEXIBLE TUBING AND CONDUITS
General Electric Co.

FLOCK EQUIPMENT AND SUPPLIES
Don Jer Products

FLUX, SOLDERING
Kester Solder Co.
Ruby Chemical Company

FOLDING RULES
Millers Falls Co.
Stanley Tools

FORGE TOOLS
Stanley Tools

FORGES, Annealing & Melting
American Gas Furnace Co.
Sunbeam Corp.

FORGES, GAS
American Gas Furnace Co.
Sunbeam Corp.

FOUNDRY EQUIPMENT & SUPPLIES
Brodhead-Garrett Co.
Sterling Wheelbarrow Co.

FREQUENCY METERS Portable and Switchboard
Weston Electric Instrument Co.

FURNACES, Annealing, Case-Hardening, Heat Treating, Metal Melting, Soldering, Tempering
American Gas Furnace Co.
General Electric Co.
Johnson Gas Appliance Co.
Sunbeam Corp.

FURNACES, FORGING
American Gas Furnace Co.
Sunbeam Corp.

FUSES, STANDARD
General Electric Co.

G

GALVANOMETERS
General Electric Co.
Weston Electric Instrument Co.

GAUGES, BIT
Millers Falls Co.
Stanley Tools

GAUGES, CABINET, RULE AND SQUARE
Stanley Tools

GAUGES, CALIPER
Atlas Press Co.
Starrett Co., L. S.

GAUGES, MARKING
Atlas Press Co.
Disston & Sons, Inc., Henry
Millers Falls Co
Stanley Tools
Starrett Co., L. S.

GAUGES, THICKNESS AND THREAD
Atlas Press Co.
Starrett Co., L. S.

GEAR SHIFT DRIVES & MOTORS
Lima Elec. Motor Co.

GENERATOR TEST BENCHES
General Electric Co.

GLASS CUTTER
Red Devil Tools

GLAZING TOOLS
Red Devil Tools

GLUE
Franklin Glue Company
Higgins Ink Co., Inc.

GLUE POTS, ELECTRIC
Black & Decker Mfg. Co.
General Electric Co.
Oliver Machinery Co.
Sta-Warm Elec. Co.
Wallace & Co., J. D.

GOUGES
Millers Falls Co.
Stanley Tools

GRINDERS AND BUFFERS, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Boice Crane Company
Chicago Wheel & Mfg. Co.
Delta Mfg. Co.
Dremel Mfg. Co.
Porter-Cable Machine Co.
Rockford Machine Tool Co.
Snap-On Tools, Inc.
Stanley Electric Tools

GRINDERS, BENCH
Atkins & Co., E. C.
Atlas Press Co.
Black & Decker Mfg. Co.
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Mummert-Dixon Co.
Porter-Cable Machine Co.
Rockford Machine Tool Co.
Snap-On Tools, Inc.
Stanley Electric Tools

GRINDERS, OILSTONE
Mummert-Dixon Co.
Rockford Machine Tool Co.
Wallace Co., J. D.

GRINDERS, PEDESTAL TYPE
Atlas Press Co.
Black & Decker Mfg. Co.
Delta Mfg. Co.
Mummert-Dixon Co.
Porter-Cable Machine Co.
Rockford Machine Tool Co.
Snap-On Tools, Inc.
Stanley Electric Tools
Walker-Turner Co., Inc.

GRINDERS, TOOL ROOM
Boyar-Schultz Corp.

GRINDING MACHINES Plain, Universal, Centerless
Atlas Press Co.
Cincinnati Milling Mach. Co.

GRINDERS, SURFACE
Boyar-Schultz Corp.

GRINDING WHEELS
Atkins & Co., E. C.
Atlas Press Co.

H

HACKSAW BLADES
Disston & Sons, Inc., Henry
Lipe-Rollway Corporation
Millers Falls Co.
Snap-On Tools, Inc.

HACKSAWS
Lipe Rollway Corp.
Millers Falls Co.
Misener Mfg. Corp.
Proto Tools
Snap-On Tools, Inc.
Starrett Co., L. S.

HAMMERS
Millers Falls Co.
Plumb. Inc., Fayette R.
Snap-On Tools, Inc.
Stanley Tools

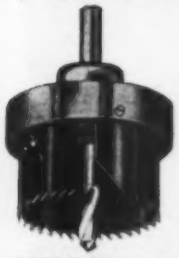
HAMMERS, BALL-PEEN CROSS-PEEN, SLEDGE
Plumb, Inc., Fayette R.
Snap-On Tools, Inc.
Stanley Tools

HAMMERS, BLACKSMITH
Plumb, Inc., Fayette R.
Stanley Tools

The ORIGINAL SAW - For Every Purpose

MISENER
ROTARY HACK SAW

TEACH the Modern EFFICIENT WAY TO
CUT FINISHED HOLES
and Circular Grooves
IN METAL, WOOD, PLASTICS
and other materials with ELECTRIC DRILLS and BIT BRACE — on DRILL PRESSES and LATHES



MISENER Single-blade Tools in graduated fractional diameters from
5/8" to 15"
and low-cost replacement blades. Make cuts from 1/8" to 2" deep. MISENER Blades are non-shatterable — a safety feature. Special SPEEDEX Blades for cutting extra-hard metals.

HOLE-Master
Multiple-blade Tools
Various tool heads are grooved to accommodate all sizes of rotary saw blades in a set of 4, 5, 6, 7, 9, or 11 diameter sizes.

WRITE TODAY for Catalog-Pricelist and special offer to School Shops.

MISENER Manufacturing Company, Inc.
Dept. SS 202 Walton St. Syracuse 2, N. Y.

ELECTRIC KILNS
Any Size — Any Temperature
Quick Delivery
JAMES W. WELDON
Laboratory
2315 Harrison St., Kansas City 8, Mo.

BIG HIT with Industrial Arts Teachers!

Gilbert & Miller's desk-pen offer so enthusiastically received country-wide, ad is repeated on PAGE 70A.

- Bookbinding Equipment & Supplies
- Rubber Stamp Making Equipment & Supplies
- Wall Chart — "Sixteen Steps in the Binding of Books" free to teachers.

G. A. PRATT COMPANY
1108 W. Chicago Avenue East Chicago, Ind.

METAL CRAFTS
Tools, Materials and Supplies
- Hammers, anvils, enamels, etching materials, books and findings.

Send 50¢ for our new catalog 1A. Payment credited on first $3.00 order.

METAL CRAFTS SUPPLY COMPANY
10 Thomas Street Providence, Rhode Island

SHOP EQUIPMENT NEWS

(Continued from page 92A)

greatly expanded service repair and stockroom space, a modern show room for adequate display of Black & Decker's wide range of portable electric tools, and a spacious L-shaped parking lot for customer use.

The factory-trained service personnel, under Service Engineer R. A. Lomas, will be augmented and equipped with the facilities for prompt repair to meet the growing use of Black & Decker, Van Dorn and Home-Utility tools in southern California, Arizona, and southern Nevada.

Waldo E. Bair is Los Angeles branch manager for Black & Decker, whose home offices and factory are at Towson, Md.

For brief reference use IAVE — 0317.

SAW TIPS FROM DE WALT

When the firm De Walt, Inc., Lancaster, Pa., had first set up a schedule for their helpful publication, *Saw Tips*, they thought of it in terms

(Continued on page 96A)

FASCINATING
MATERIALS &
IDEAS
Get our big new '52 Catalog for your Craft Class. Contains hundreds of items for making jewelry, textile painting, weaving, leather goods, plastics and metal. Tools, equipment and instruction books. Write today!
CRAFTSMAN SUPPLY HOUSE
SCOTTSVILLE, N.Y

CASTINGS
For school projects. Build HOME WORKSHOP MACHINES. Designed for ease in machining and as projects for top interest and instruction. We will be glad to send descriptive literature on our DEPENDABLE CASTINGS and blue prints.

DESIGNERS COMPANY
724 MUNROE AVE. RACINE, WIS.

LAMP PARTS
SPEEDY 24 HOUR SERVICE on Lamp Parts from one of the most complete stocks in the country.
SHOP TEACHERS: Send for FREE 64-page catalog containing complete instructions and listing every part necessary to build lamps.
GYRO LAMP AND SHADE CORP.
54025 N. Clark St. Chicago 40, Ill.

Plastics and Supplies
Schools in every state of the Nation use us as their principal source of supply.
We are a leader in the Plastics field. Write for *free* list of plastics, materials, and supplies. Our prices are lower.
PLASTIC SUPPLY COMPANY
2901 N. Grand Blvd. St. Louis 7, Mo.

LEATHERCRAFTSMEN
- Most complete leathercraft stock in the midwest. Manufacturers of beveled lacing, billfold kits and purse projects, tools, patterns, leather, hardware.

WRITE FOR CATALOGUE
Leather Products Company
Box 596 Sioux Falls, South Dakota

ALL THESE CRAFTS
IN ONE HANDY REFERENCE BOOK
We Carry A Complete Stock of Tools — Supplies — Kits For All These Crafts
Leatherwork — Ceramics — Knitting — Metalcraft — Textile Painting — Shellcraft — Block Printing — Braiding — Glass Etching — Wood Carving — Raffia — Plastic Craft In All Its Forms—Wood Burning—Miniature Models.
Patterns & Woodworking, White Pine For Carving.
Send For Our 80 Page Handcraft Reference Book . . . Free to Instructors — Students 15c
CRAFTERS OF PINE DUNES • Oostburg, Wis.

ARE YOU TEACHING CERAMIC?
- Complete line of ceramic supplies and equipment for school and studio use. Kilns, wheels, spray guns, tools books, clay, glazes, and colors. A large selection of excellent molds.

Over ten years experience teaching ceramics and producing ceramic articles.
Let us help you set up a ceramics course in your school or community.
Write for further information.
SEELEY'S CERAMIC SERVICE
LIVINGSTON MANOR NEW YORK

IF IT'S LEATHER, we have it! Choose from one of the largest stocks of leather, lacing, kits, and leathercraft accessories in the country. Send for free catalog, and price list full of project ideas, etc.
We have been a leather headquarters since 1910, and we specialize in fast and dependable service.
SAX BROTHERS, INC.
Dept. IA 1111 No. 3rd St. Milwaukee 3, Wisconsin

High Grade
Printing Inks
For SCHOOL PRINT SHOPS
COVERWELL INKS FOR QUALITY PRINTING
MARTIN DRISCOLL & CO.
610 Federal St. Chicago, Ill. Portland, Oregon 407 E. Michigan St. Milwaukee, Wis.

HAMMERS, LEAD AND SOFT FACE
Proto Tools
Snap-On Tools, Inc.
Stanley Tools

HAMMERS, PORTABLE ELECTRIC
Stanley Electric Tools

HAND SAWS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Millers Falls Co.

HAND SAWS, PORTABLE ELECTRIC
Porter-Cable Machine Co.
Stanley Electric Tools

HAND SCREWS
Adjustable Clamp Co.
Cincinnati Tool Co.

HANDICRAFT SUPPLIES
Brodhead-Garrett Co.
Craftsman Supply House
Craftsman Wood Service Co.
Gearon Company, The
Gyro Lamp & Shade Corp.
Hammett Co., J. L.
Larson Co., J. C.
X-Acto Crescent Products Co., Inc.

HARDIES
Stanley Tools

HEAT-FLOW METERS
Weston Electric Instrument Corp.

HEATING ELEMENTS, ELECTRIC
Electric Hotpack Company, Inc.

HEAT-TREATING EQUIPMENT
American Gas Furnace Co.
Electric Hotpack Company, Inc.
Johnson Gas Appliance Co.
Sunbeam Corp.

I

INDICATING INSTRUMENTS, ELECTRIC
General Electric Co.
Weston Electric Instrument Co.

INK REMOVERS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

INKS, DRAWING AND COLORED
Higgins Ink Co., Inc.
Post Company, Frederick
Weber Company, F.

INKS, PRINTING
American Type Founders Sales Corp.
Driscoll & Co., Martin

J

JACKETS, SNAP, FLASK, AND MOLD
Oliver Machinery Co.

JACKS, HYDRAULIC
Blackhawk Mfg. Co.

JEWELERS' TOOLS, EQUIPMENT AND SUPPLIES
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.

JIG SAWS
Boice Crane Company
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Co
Disston & Sons, Inc., Henry
Duro Metal Products Co.
Oliver Machinery Co.
Shopmaster, Inc.
Syncro Corp.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS
Boice Crane Company
Delta Mfg. Co.
De Walt Products Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Shopmaster, Inc.
Stanley Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, BENCH
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, HAND
Atkins & Co., E. C.
Delta Mfg. Co.
Yates-American Machine Co.

K

KEENE CEMENT
Brodhead-Garrett Co.
General Finishes Sales & Serv.

KILNS
Electric Hotpack Company, Inc.
Harper Electric Furnace Corp.
Weldon Laboratories, James

KNIVES, BAND
KNIVES, MACHINE
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Yates-American Machine Co.

KNIVES, HOBBY
X-Acto Crescent Prod. Co.

KNIVES, PAPER CUTTER
American Type Founders Sales Corp.

KNIVES, SLOYD
Robert Murphy's Sons Co.

KNOCK-DOWN FURNITURE
Giles & Kendall

KNURLS
Armstrong Bros. Tool Co.
Williams & Co., J. H.

L

LABORATORY STANDARD INSTRUMENTS
Weston Electric Instrument Co.

LAMPS, MINIATURE
General Electric Co.

LATHE ATTACHMENTS
Armstrong Bros. Tool Co
Atlas Press Co.
Cincinnati Lathe & Tool Co.
Dumore Company, The
South Bend Lathe Works

LATHES, Bench, Metal Working
Atlas Press Co.
Boice Crane Company
Duro Metal Products Co.
LeBlond Machine Tool Co., R. K.
Logan Engineering Co.
Sheldon Machine Co., Inc.
South Bend Lathe Works

LATHES, GAP BED
Boice Crane Company
Cincinnati Lathe & Tool Co.
LeBlond Machine Tool Co. Inc.
Walker-Turner Co., Inc.

LATHES, SMALL PRECISION
Atlas Press Co.

LATHES, SPINNING
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.

LATHES, WOODWORKING
Atlas Press Co.
Boice Crane Company
Brodhead-Garrett Co.
Delta Mfg. Co.
De Walt Products Co.
Duro Metal Products Co.
Oliver Machinery Co.
Shopmaster, Inc.
Shopsmith
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

LEAD AND RULE CUTTERS
American Type Founders Sales Corp.
Rouse Co., H. B.

LEATHER
Connolly, J. J.
Crown Leather Co.
Larson Co., J. C.
Leather Products Co.
Russo Handicraft Supplies
Sax Brothers Co.
Tandy Leather Co.

LEATHER WORKING TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Connolly, J. J.
Crown Leather Co.
Dremel Mfg. Co.
Indianhead Archery & Mfg. Co.
Larson Co., J. C.
Leather Products Co.
National Western Supply Co.
Osborn Bros.
Russo Handicraft Supplies
Sax Brothers Co.
Tandy Leather Co.
X-Acto Crescent Prod. Co.

LETTERS AND FIGURES FOR STAMPING METALS
Atlas Press Co.

LEVELS
Disston & Sons, Inc., Henry
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

LINOLEUM AND RUBBER BLOCKS AND ENGRAVING TOOLS
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.

LINOLEUM, BLOCK CUTTING AND PRINTING TOOLS AND SUPPLIES
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.

LOOM CLAMPS
General Electric Co.

LOOMS
Hammett Co., J. L.

LUMBER
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Foley Lumber Co., T. A.
Giles & Kendall
Paxton Lumber Co., Frank
Tegge Lumber Co.

LUMBER — HARDWOODS
Tegge Lumber Co.
Hardwood Corp. of America

M

MACHINE KNIVES, JOINTER AND SURFACER
Atkins & Co., E. C.
Boice Crane Company
Yates-American Machine Co.

MACHINE LIGHTS
Atlas Press Co.
Boice Crane Co.

MACHINISTS' TOOLS
Atlas Press Co.
Do All Co.
Lufkin Rule Co.
Starrett Co., L. S.

MALLETS, HICKORY, RUBBER, RAWHIDE
American Type Founders Sales Corp.
Proto Tools
Snap-On Tools, Inc.
Stanley Tools

MANUAL-TRAINING TOOLS AND SUPPLIES
Atkins & Co., E. C.
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Company
Craftsman Wood Service Co.
Cincinnati Tool Co.
Dremel Mfg. Co.
Greenlee Tool Co.
Larson Co. J. C.
Millers Falls Co.
Murphy's Sons Co., Robert
Proto Tools
Stanley Tools
Starrett Co., L. S.

MANUAL-TRAINING VISES
Atlas Press Co.
Columbian Vise & Mfg. Co.
Millers Falls Co.
Morgan Vise Co.

MEASURING INSTRUMENTS, ELECTRIC
General Electric Co.
Weston Electric Instrument Co.

MELTING POT EQUIPMENT
American Gas Furnace Co.
General Electric Co.
Johnson Gas Appliance Co.
Sunbeam Corp.

METAL CRAFT TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
Duro Metal Products Co.
Metal Crafts Supply Co.
O'Neil Irwin Mfg. Co.
Snap-On Tools, Inc.

METAL CUTTING SAWS
Kalamazoo Tank & Silo Co.
Lipe Rollway Corp.
Racine Tool & Mach. Co.

METAL SHEARS, ELECTRIC
Stanley Electric Tools

METAL SPINNING EQUIPMENT
Oliver Machinery Co.

METAL STAMPING MACHINES
O'Neil Irwin Mfg. Co.

METALS FOR HANDICRAFT
Hubbell Metals, Inc.

METALS, SHEET
Metal Crafts Supply Co.

METALWORK HARDNESS TESTERS
Ames Precision Mach. Works

METRIC SCALES, FLAT
Dietzgen Co., Eugene
Post Company, Frederick

MICA
General Electric Co.

MICROMETERS
Snap-On Tools, Inc.
Starrett Co., L. S.

MICROFARAD METERS
Weston Electric Instrument Co.

MILLING ATTACHMENTS
Atlas Press Co.
Cincinnati Milling Mach. Co.

MILLING MACHINES
Cincinnati Milling Machine Co.
Kearney & Trecker Corp.

MITER BOXES
Atkins & Co., E. C.
Millers Falls Co.
Stanley Tools

MITERING MACHINES, HAND AND POWER (Printing)
American Type Founders Sales Corp.
Rouse Co., H. B.

MODEL BUILDINGS
Architectural Model Materials, Inc.

MODELING TOOLS
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.

MORTISERS
Boice Crane Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

MOTOR GENERATOR SETS
General Electric Co.

MOTORS, ELECTRIC
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
General Electric Co.
Walker-Turner Co., Inc.

N

NIPPERS, Cutting, Jewelers'
Starrett Co., L. S.

NUMBERING MACHINES
American Type Founders Sales Corp.

O

OHMMETERS, PORTABLE
Weston Electric Instrument Co.

OILSTONE TOOL GRINDER, Power
Mummert-Dixon Co.
Oliver Machinery Co.
Wallace Co., J. D.

OUTLETS, SWITCHBOXES
General Electric Co.

OZALID PAPER
Dietzgen Co., Eugene

P

PAGE FRAMES
American Type Founders Sales Corp.
Rouse Co., H. B.

PAINTS AND VARNISHES
Pittsburgh Plate Glass Co.

Cut-away view showing how heating element completely covers sides and bottom of pot to maintain even heat distribution at low wattage.

GLUE HEATERS FOR SCHOOL WOODWORKING SHOPS

Capacities for all sizes of school shops. 110 Volt A-C. Removable spun copper inserts, bail and brushwiper. Automatic thermostat control. Just plug into wall socket and forget this heater. Will not overheat and burn contents.

Write for illustrated folder for description, sizes, prices.

STA-WARM ELECTRIC CO.
50 N. Chestnut St.
RAVENNA, OHIO

Scrape paint quickly
ask your dealer for
Red Devil
Wood Scrapers

Send for the *NEW* 96 page
Red Devil catalog No. 21
Address Dept. I.V.
RED DEVIL TOOLS, IRVINGTON 11, N. J., U. S. A.

FURNACES
for heat treating, melting, etc.

AMERICAN GAS FURNACE COMPANY
900 LAFAYETTE STREET ELIZABETH 4, NEW JERSEY

YOUR STUDENTS *Can Easily Make* CRAFT LEATHER PROJECTS

If you have not received our new #18, 68-page Catalog, which has in it hundreds of Craft items of interest to your Crafts Department, we will be glad to send one to you.

CRAFT PROJECTS • INSTRUCTION BOOKS
PATTERNS • LACINGS • TOOLING LEATHERS
Put-Together Projects for Young and Old.

OSBORN BROS. SUPPLY COMPANY
House of Leathercraft for 34 Years
223 West Jackson Boulevard Chicago 6, Illinois

TACKLE BUILDING

A Stimulating Shop Project

Write for Complete Information

EMPIRE TACKLE COMPANY
6 Genesee Street, New Hartford, N.Y.

SHOP EQUIPMENT NEWS

(Continued from page 94A)

of a weekly publication. However, after working with it for the past few months, they found that a better publication would result if it were published every other week. Therefore, *Saw Tips* will be published every other Thursday beginning with this issue.

The present issue presents "Light Frame Construction, Terminology and Cutting."

Woodworking teachers who do not receive *Saw Tips* should write to *De Walt, Inc., 73 Fountain Ave., Lancaster, Pa.*

For brief reference use IAVE — 0319.

THE S. H. DUMVILLE ELECTRONICS EDUCATOR

A newly designed aid for teachers of electricity and electronics, recently perfected, will greatly shorten the time for building and trying out circuits.

It is the outgrowth of a military officer's experience and has been thoroughly tested in the classroom.

With it, experimental circuits can be built in seconds, requires no soldering, assists in performing laboratory demonstrations, shoot trouble, and evaluate student learning.

For specific information on this valuable teaching aid address *S. H. Dumville, 2500 Wisconsin Ave., Washington 7, D. C.*

For brief reference use IAVE — 0320.

NEW RED DEVIL CATALOG

Red Devil Tools has issued a new 96-page catalog (No. 21) covering all Red Devil products. It is profusely illustrated and designed for quick reference use. The catalog includes glass cutters and all types of glaziers' tools; putty knives and wall scrapers; wood, paint, and glass scrapers;

(Continued on page 98A)

KNOCKDOWN CEDAR CHEST
and Aromatic Red Cedar Lumber

Write for Free Price List Today
GILES & KENDALL CO., Huntsville, Ala.

CROWN IS "TOPS" IN LEATHERCRAFT

Students can easily make Bags, Belts, Moccasins, Keycases etc. with our low-priced "easy to assemble" kits for fun or profit. Complete line of tools and accessories. Carving cowhide and all CRAFT LEATHERS.
Write to Dept. E
FREE Illustrated CATALOG

CROWN LEATHER CO.
22 SPRUCE ST.
NEW YORK 38, N.Y.

• Circles • Tooling Sheet • Flat Sheet
• Kits • Designs • Tools • Accessories

ALUMINUM and PEWTER DISCS still available for making TRAYS!

We also supply Designs, Asphaltum and Remover, Steel Wool, Plastic Luster, Brushes, Free Directions, etc.

FREE IMMEDIATE DELIVERY! Your order shipped same day received. We prepay delivery on cash orders.

FREE PRICE LIST sent on request. Write today.

HUBBELL METALS INC.
2817 Ladede Ave. Dept. IA-6 St. Louis 3, Mo.

TECHNICAL ART BOOKS
For Arts and Crafts Studios and Reference Libraries

Art Alphabets and Lettering	$4.50
Art Monograms and Lettering	6.00
Condensed paper edition	2.50
Ornamental Designs & Illustrations	6.00
Illus. Manual of Heraldic Designs, with 2000 armorial figures, dictionary	10.00
Jewelry Engraving Course, Winters	3.50

Imported Jewelry Design books, specialized subjects, Decorative Art and Heraldry.

V. C. BERGLING, Publisher
Box 523-E Coral Gables, Fla., U.S.A.

FOR FUN OR PROFIT — LEATHERCRAFT, TEXTILE PAINTING, COPPER TOOLING, KITS, PROJECTS, TOOLS, SUPPLIES

REMEMBER **RUSSO** for ALL LEATHER & CRAFT SUPPLIES!

SEND 25¢ FOR OUR BIGGEST CATALOG YET — 25¢ REFUNDED WITH 1ST ORDER

RUSSO HANDICRAFT SUPPLIES Dept 2V 245 S. Spring, Los Angeles 12, Calif

LOOMS, Table and Foot
Reed, Raphia, Handicraft Supplies
Send for catalog
J. L. HAMMETT CO.
CAMBRIDGE, MASS.

FREE
INSTRUCTION BOOK on METAL SPINNING
sent to instructors on request.
BOICE-CRANE COMPANY
932 Central Avenue • Toledo 6, Ohio
Headquarters for spinning lathes; spinning tools and accessories for most makes of lathes

MAKE SURE YOU HAVE . . . DonJer's New School Catalog of Pre-Selected Project Equipment and Supplies. Every item selected with the advice of hundreds of teachers. Every DonJer product is practical, useful and fits into your curriculum.

HERE IS YOUR DonJer CATALOG

WRITE FOR YOUR FREE COPY

NEW FINISHES: Wrinkle and Kristal for wood and metal . . . Golden Touch (23K gold) and Mirror Touch. Also craft kits, camera building kit, beginners photo kit, etc.

DONJER PRODUCTS COMPANY
51-47 89th Street
Woodside 77, L. I., N. Y.

PANEL BOARD ELECTRIC
General Electric Co.

PAPER, CLOTH-BACKED
Dietzgen Co., Eugene
Post Company, Frederick

PAPER CUTTERS
American Type Founders Sales Corp.
Dietzgen Co., Eugene

PAPER, DETAIL, RULED
Dietzgen Co., Eugene
Post Company, Frederick
U. S. Blue Print Paper Co.
Weber Company, F.

PAPER, DRAWING AND TRACING
Dietzgen Co.,Eugene
Post Company, Frederick
U. S. Blue Print Paper Co.
Weber Company, F.

PASTE
Higgins Ink Co., Inc.

PENCILS, PLAIN, COLORED, DRAWING, WORKING
American Lead Pencil Co., Inc.
Dietzgen Co., Eugene
Eagle Pencil Company
Post Company, Frederick
U. S. Blue Print Paper Co.
Weber Company, F.

PENS, INK SHADING
Dietzgen Co., Eugene
Hunt Pen Co., C. Howard
Post Company, Frederick
U. S. Blue Print Paper Co.

PENS, LETTERING
Dietzgen Co., Eugene
Hunt Pen Co., C. Howard
Post Company, Frederick
U. S. Blue Print Paper Co.

PENS, FOUNTAIN, DESK
Gilbert & Miller

PEWTER
Metal Craft Supply Co.

PHASE ANGLE METERS
Weston Electric Instrument Co.

PICTURE FRAME TOOLS
Stanley Tools

PLANERS AND SURFACERS (WOOD)
Boice Crane Company
Buss Machine Works
Craftsman Wood Service Co.
Delta Mfg. Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Wallace Co., J. D.
Yates-American Machine Co.

PLANES, HAND
Millers Falls Co.
Porter-Cable Machine Co.
Stanley Tools

PLASTICS
Cadillac Plastics Co.
D. W. Cope
Craftsman Supply House
Plastic Parts & Sales
Plastic Supply Co.

PLASTICS — WOOD MATERIALS, HEAT TREATMENT
Brodhead-Garrett Co.
Electric Hotpack Company, Inc.

PLATEN PRESSES
American Type Founders Sales Corp.

PLIERS
Crescent Tool Co.
Millers Falls Co.
Proto Tools
Snap-On Tools, Inc.
Utica Drop Forge & Tool Co.
Williams & Co., J. H.

PLYWOOD AND VENEER
Brodhead-Garrett Co.
Giles & Kendall
Tegge Lumber Co.

PORCELAIN KNOBS, CLEATS, ETC.
General Electric Co.

PORTABLE ELECTRIC DRILLS
Black & Decker Mfg. Co.
Delta Mfg. Co.
Stanley Tools

PORTABLE METERS, INDICATING
General Electric Co.
Weston Electric Instrument Co.

PORTABLE WOODWORKING MACHINERY
Boice Crane Company
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co.
Wallace Co., J. D.
Yates-American Machine Co.

POTTERY EQUIPMENT CLAY AND SUPPLIES
American Art Clay Co.
B & I Mfg. Co.
Weldon Laboratory, James W.

PRESSES, VENEER
Atlas Press Co.
Yates-American Machine Co.

PRINTERS' ENVELOPE SERVICE
Western States Envelope Co.

PRINTERS' ROLLERS
American Type Founders Sales Corp.

PRINTING PRESS MOTORS
General Electric Co.

PRINTING PRESSES
American Type Founders Sales Corp.

PRINTSHOP EQUIPMENT AND SUPPLIES
American Type Founders Sales Corp.
Hamilton Mfg. Co.
Rouse Co., H. B.

PROJECTS — BLUEPRINTS & CASTINGS
Designers Company

PROJECTORS
Eastman Kodak Co.

PROOF PRESSES
American Type Founders Sales Corp.

PROTRACTORS
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
Starrett Co., L. S .
V. & E. Mfg. Company

PUBLISHERS
American Technical Society
Bergling, V. C.
Bennett Co., Chas. A.
Bruce Publishing Company
Delmar Publishers
International Textbook Co.
Macmillan Co., The
McGraw-Hill Book Co., Inc.
McKnight & McKnight
Rider Publisher, Inc., John F.
Van Nostrand Co., D.

PUNCHES, CENTER, PRICK AND SOLID
Atkins & Co., E. C.
Atlas Press Co.
Cincinnati Tool Co.
Crescent Tool Co.
Lufkin Rule Co.
Proto Tools
Williams & Co., J. H.

R

RADIO PARTS
Allied Radio

RADIO TEST EQUIPMENT
Allied Radio
Millers Falls Co.
Stanley Tools
Weston Electric Instrument Co.

RECEPTACLES, Cleat, Medium Base or Miniature
General Electric Co.

RECEPTACLES, Duplex Plate & Sign
General Electric Co.

REDUCING GLASS
Dietzgen Co., Eugene
Post Company, Frederick

REEDS AND RAFFIA
Hammett Co., J. L.

RESISTANCE BOXES, PLUG AND DIAL
Weston Electric Instrument Co.

REVOLUTION COUNTERS
Dietzgen Co., Eugene
Post Company, Frederick
Starrett Co., L. S.

RHEOSTATS
General Electric Co.

ROUTERS
Duro Metal Products Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Stanley Tools

ROUTERS, PORTABLE AND STATIONARY
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
Duro Metal Products Co.
Stanley Electric Tools
Stanley Tools
Yates-American Machine Co.

RULES, WOOD, BOXWOOD AND COMBINATION
Dietzgen Co., Eugene
Engineering Sales Company
Lufkin Rule Co.
Post Company, Frederick
Stanley Tools
Starrett Co., L. S.
U. S. Blue Print Paper Co.
Weber Company, F.

S

SAFETY GOGGLES
Willson Products, Inc.

SANDERS, BELT
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Porter-Cable Machine. Co.
Parks Woodworking Mach. Co.
Shopmaster, Inc.
Yates-American, Machine Co.

SANDERS, COMBINATION
Delta Mfg. Co
Dremel Mfg. Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Skilsaw, Inc.
Snap-On Tools, Inc.
Walker-Turner Co., Inc.
Yates-American Machine Co.

SANDERS, DISK
Atlas Press Co.
Boice Crane Company
De Walt Products Co.
Oliver Machinery Co.
Shopsmith
Shopmaster, Inc.
Snap-On Tools, Inc.
Stanley Electric Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.

SANDERS, DRUM
Boice Crane Company
Delta Mfg. Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.
Yates-American Machine Co.

SANDERS, PORTABLE
Black & Decker Mfg. Co.
Boice-Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Skilsaw, Inc.
Stanley Tools

SANDERS, SPINDLE
Boice Crane Company
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

SAW FILER
Atkins & Co., E. C.
Foley Mfg. Co.

SAW SETS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Millers Falls Co.
Snap-On Tools, Inc.
Stanley Tools

SAW TRIMMERS (PRINTING)
American Type Founders Sales Corp.
Atkins & Co., E. C.
Rouse Co., H. B.

SAWS, CIRCULAR, BAND AND HACK
Atkins & Co., E. C.
Boice Crane Company
Brodhead-Garrett Co.
Crescent Tool Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Duro Metal Products Co.
Millers Falls Co.
Shopmaster, Inc.
Starrett Co., L. S.
Walker-Turner Co., Inc.

SAWS, METALCUTTING
Racine Tool & Machine Co.

SAWS, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Porter-Cable Machine Co.
Skilsaw, Inc.
Stanley Electric Tools

SCHOOLS
Bradley University
Colorado A&M College
Milwaukee School of Engineering
New York University School of Educ.
Oregon State Agricultural College
Pennsylvania State College
University of Minnesota
University of Southern California
Wayne University
Western Michigan College

SCRAPERS, HAND AND CABINET
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Millers Falls Co.
Red Devil Tools
Stanley Tools
Starrett Co., L. S.

SCREW CLAMPS
Adjustable Clamp Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.

SCREW DRIVERS
Crescent Tool Co.
Greenlee Tool Co.
Millers Falls Co.
North Brothers Mfg. Co.
Proto Tools
Snap-On Tools, Inc.
Stanley Tools
Starrett Co., L. S.
Williams & Co., J. H.

SCREW DRIVERS, ELECTRIC
Black & Decker Mfg. Co.
Stanley Electric Tools

SCROLL SAWS
Atkins & Co., E. C.
Boice Crane Company
Delta Mfg. Co.
Millers Falls Co.
Shopmaster, Inc.
Walker-Turner Co.
Wallace & Co., J. D.

SEMI-PRECIOUS STONES
Metal Crafts Supply Co.

SHAPERS, ELECTRIC
Boice Crane Company
Porter-Cable Machine Co.
Stanley Electric Tool Co.

SHAPERS, METAL
Atlas Press Co.
Rockford Machine Tool Co.

SHAPERS, WOODWORKING
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Shopmaster, Inc.
Stanley Electric Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

SHEARS AND SCISSORS, FOR CUTTING METALS
Berkroy Products, Inc.
Black & Decker Mfg. Co.
Crescent Tool Co.
Snap-On Tools, Inc.
Utica Drop Forge & Tool Corp.

SHEET METAL EQUIPMENT AND SUPPLIES
Berkroy Products, Inc.
Brooks Co., Inc. R.D.

SHOP COATS AND APRONS
Canvas Products Corp.

SILK SCREEN PROCESS
American Type Founders Corp.

SILVERSMITHS' TOOLS AND SUPPLIES
Metal Crafts Supply Co.

SKETCH BLOCKS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

SLIDE RULES
Dietzgen Co., Eugene
Post Company, Frederick
U. S. Blue Print Paper Co.
V. & E. Mfg. Company

SOCKETS AND RECEPTACLES
General Electric Co.

SOLDERING FURNACES
American Gas Furnace Co.
General Electric Corp.
Johnson Gas Appliance Co.
Sunbeam Corp.

SOLDERING IRONS, ELECTRIC
General Electric Co.
Snap-On Tools, Inc.
Stanley Tools
Weller Mfg. Co.

SOLDERING SOLUTIONS
Ruby Chemical Company

SOLDERS, ALL KINDS
Atkins & Co., E. C.
Kester Solder Co.
Ruby Chemical Company

MODEL BUILDINGS
ACCURATE • ECONOMICAL
EASY TO BUILD

Miniature houses, farm and commercial buildings, etc., are easily built with our professionally designed prefabricated materials — shingles, brick and siding on plywood panels; white plastic doors, windows, etc. — accurately detailed and scaled to ¼" and ½". They're economical, interesting and eliminate the tedious part of model building — producing realistic results. Used by many schools for instruction, contests and projects.

Catalog FREE to Instructors

Write today for free samples and catalog, containing ideas and instructions.

Write to Dept. V32

ARCHITECTURAL MODEL MATERIALS
Incorporated
4208 Armitage Ave. Chicago 39, Ill.

The IMPROVED TAPERED DRILL FOR INTERNAL CARVING IN PLASTICS

Hand ground, fast cutting, high speed steel with sharp points. Standard lengths and stub (1½"), both in regular and high spiral for 1/16", 3/32", and ⅛" collets and Jacobs chuck. Prices on all our drills have been reduced up to 25%. Write for new prices.

JOBBER INQUIRIES INVITED

ELBAR PRODUCTS
2348 E. 17th Street Brooklyn 29, N. Y.

SHEET METAL MACHINERY

CHICAGO BENDING BRAKES
ADJUSTABLE BAR FOLDERS
SQUARING SHEARS — CIRCLE SHEARS
SLIP ROLLS — ROTARY MACHINES
PITTSBURGH LOCK MACHINES
SPOT WELDERS — ARC WELDERS
POWER PRESSES — FOOT PRESSES
FLOOR, BENCH & PORTABLE DRILLS
COMPLETE SHOP EQUIPMENT NEW — USED

• *Please specify machines required and write us direct for catalogs and prices.*

B. D. BROOKS CO., Inc.
Tel. HANcock 6-5200
361 Atlantic Ave. Boston 10, Mass.
—M11

Electro-Typers

Especially qualified to be of service to the school printshop.

Promptness and quality assured.

Forms returned same day received.

Badger - American Electrotype Co.
600 Montgomery Bldg.
407 East Michigan St. Milwaukee, Wis.

SHOP EQUIPMENT NEWS

(Continued from page 96A)

paint conditioning machines; floor conditioning machinery; and many hardware specialties such as electric fencers, Grady wedges, roller painters, pot cleaners, and masonry drills.

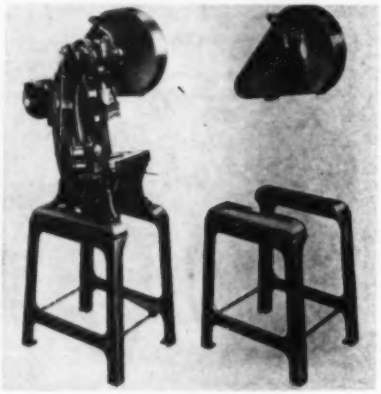
Product specifications are interspersed with valuable directions and technical data relative to proper tool application and care.

For a copy of this catalog write to *Red Devil Tools, Irvington 11, N. J.*

For brief reference use IAVE — 0321.

BENCHMASTER PUNCH PRESS

Benchmaster offers a new series of belt guards in three sizes especially designed for use with the Benchmaster 1-ton, 4-ton standard, 4-ton deep throat, and 7½-ton punch presses. The belt guards are equipped with suitable mounting brackets for



Benchmaster punch press

use on respective presses and insure extra operator safety.

An additional Benchmaster product is the newly designed cast iron legs. These may be used with both 4-ton presses and the 7½-ton press illustrated. Wide spacing of feet insures stability. Legs are equipped with a pedal which connects to the clutch for convenient foot control. Prices and descriptive information are available from *Benchmaster Manufacturing Company, 2952 West Pico Blvd., Los Angeles, Calif.*

For brief reference use IAVE — 0322.

CAMP POSITION

• Boys' camp in Lenox, Mass., has position for experienced crafts counsellor with flair for working with boys. Wood, leather, metal.

SEND FULL DETAILS

JOSEPH KRUGER, Director
375 Osborne Terrace, Newark 8, N. J.

TEACH IN CHICAGO

• Examinations for teachers of the following subjects in the Chicago Public High Schools will be held April 28, 1952:

AUTO, ELECTRIC, FORGE, FOUNDRY, INDUSTRIAL ARTS, MECHANICAL DRAWING, PRINT, MACHINE, AND WOOD SHOPS.

Closing date for filing formal application forms and required credentials is April 14, 1952.

For information apply to:

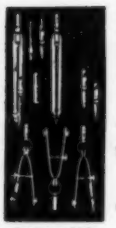
BOARD OF EXAMINERS
228 N. LaSalle St. Chicago 1, Illinois

QUALITY DRAWING MATERIALS

High grade drawing materials at exceptionally low prices.

Hundreds of satisfied instructors and teachers agree our Educational Discounts offer more materials at greater savings, allowing students more for their dollars. Wide selection of Drafting Sets, Complete Drawing Outfits, single Instruments, T-Squares, Drawing Boards, Triangles, Rules, and many other drawing aids. Sets and Instruments are imported from the U. S. Zone of Germany from renowned manufacturers.

NOTE — We maintain our own service department and repair and replace all types of drawing instruments at a very nominal charge. Master Repair Kits are also supplied for Instructors.



Set No. 912

Compare our price with these features:
- 12 piece Drawing Set
- Fine nickled finish prevents rusting
- 3 Free action bows
- 5½" Compass and Divider with special bearings in the head for lasting service
- 2 Ruling Pens with black dural handles
- 2 Flap velvet-lined snap case **$8.95**

Less our Special Educational Discounts given to schools and student groups

Samples upon request — Write for our latest catalogue and price list

ALVIN CO., IMPORTERS
of Drawing and Measuring Instruments
Windsor, Connecticut
"Quality at the Right Price"

Established 1892
LEATHER Headquarters
Where Beginners, Amateurs and Professional are all equally welcome! Mail orders filled promptly. Catalog on request.

If you can find Brooklyn Bridge you can find CONNOLLY'S! Courteous and expert leathermen will help you in this mecca of tools, accessories and lacing amidst a galaxy of fine leathers — just the place you've been looking for! Mail your order now!

J. J. CONNOLLY
181 William St., N. Y. 38, N. Y.
Dept. 4C

SOMETHING NEW the **EE** **Electronics Educator** Pat. Pend.

The *Dumville* Electronics Educator is a new design for teaching electronics rapidly and thoroughly — NO SOLDERING — Build many circuits in minutes — A DIRECT OUTGROWTH OF A MILITARY OFFICER'S EXPERIENCE — Five years actual classroom use before release. For details write

S. H. DUMVILLE
2500 Wisconsin Ave. NW
Washington 7, D. C.

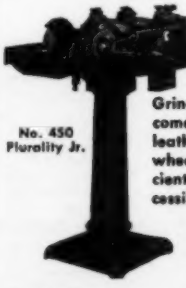
MAKE BOWS and ARROWS

• One of the best shop projects; interesting and useful. THE FLAT BOW BOOK shows how.....75 cents

CATALOG FREE (stamp appreciated)

INDIANHEAD ARCHERY MFG. CO.
Box 303-BP Lima, Ohio
31 years of good materials.

TOOLS ALWAYS SHARP WITH PLURALITY OILSTONE TOOL GRINDERS



No. 450 Plurality Jr.

NOW AVAILABLE IN 3 SIZES
No. 425 Plurality Sub Jr.
No. 450 Plurality Jr.
No. 475 Plurality

Grinding can be done on a come, coarse or fine or emery leather stropping or emery wheels. Unit is compact, efficient, serviceable, easily accessible and has ball bearing direct motor drive. Especially guarded for school shop use. Details on request.

MUMMERT-DIXON CO.
HANOVER, PENNSYLVANIA
Originators and Pioneer Manufacturers of Oilstone Tool Grinders

SOLDERS, FLUX FILLED
Kester Solder Co.
Ruby Chemical Company

SPINDLE CARVERS
Oliver Machinery Co.
Yates-American Machine Co.

SPINNING EQUIPMENT AND TOOLS
Atlas Press Co.
Boice Crane Company
Oliver Machinery Co.
Walker-Turner Co., Inc.

SPOKESHAVES
Millers Falls Co.
Stanley Tools

SQUARES, BEVEL
Millers Falls Co.
Stanley Tools

SQUARES, FRAMING
Millers Falls Co.
Stanley Tools

SQUARES, MITER
Disston & Sons, Inc., Henry
Millers Falls Co.
Stanley Tools

SQUARES, TRY
Disston & Sons, Inc., Henry
Starrett Co., L. S.

STAINS
General Finishes Sales & Service Co.

STAMPS, Letters and Figures
Atlas Press Co.
Cunningham Co., M. E.

STANDARD CELLS
Weston Electric Instrument Co.

STARTERS, MOTOR, Electric
General Electric Co.

STEEL RULES
Atkins & Co., E. C.
Dietzgen Co., Eugene
Post Company, Frederick
Snap-On Tools, Inc.
Starrett Co., L. S.

STEEL SQUARES
Dietzgen Co., Eugene
Millers Falls Co.
Post Company, Frederick
Stanley Tools
Starrett Co., L. S.

STENCILS, SILK SCREEN
American Type Founders Sales Corp.

STOOLS
Dietzgen Co., Eugene
Engineering Sales Company
Hamilton Mfg. Co.
Post Company, Frederick
Weber Company, F.

STORAGE BATTERY TESTING INSTRUMENTS
Weston Electric Instrument Co.

SWING SAWS
Wallace & Co., J. D.

SWITCHBOARDS
General Electric Co.
Weston Electric Instrument Co.

SWITCHBOXES
General Electric Co.

SWITCHBOXES, OUTLET
General Electric Co.

SWITCHES, SAFETY
General Electric Co.

SWITCHES, REVERSING
Atlas Press Co.

SWITCHES, SAFETY INCLOSED
General Electric Co.

SWITCHES, SNAP, PUSH BUTTON, AND PLUG
General Electric Co.

T

TABLES, DRAFTING
Dietzgen Co., Eugene
Engineering Sales Co.
Hamilton Mfg. Co.
V. & E. Mfg. Company

TACHOMETERS, ELECTRIC
Weston Electric Instrument Co.

TACKS, THUMBS, STEEL AND BRASS
Dietzgen Co., Eugene
Post Company, Frederick

TAPE, MEASURING
Dietzgen Co.,Eugene
Post Company, Frederick
Weber Company, F.

TAPS AND DIES
Armstrong Bros. Tool Co.
Snap-On Tools, Inc.

T SQUARES
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
Starrett Co., L. S.
U. S. Blue Print Paper Co.
V. & E. Mfg. Company
Weber Company, F.

TEMPERING AND DRAWING SALTS
Sunbeam Corp.

TENONERS
Oliver Machinery Co.
Yates-American Machine Co.

TEST EQUIPMENT, ELECTRICAL
General Electric Co.
National Forge — Ordnance Co.
Weston Electric Instrument Co.

THREAD-CUTTING TOOLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Cincinnati Lathe & Tool Co.
Snap-On Tools, Inc.
South Bend Lathe Works
Williams & Co., J. H.

TONGS
Stanley Electric Tools
Starrett Co., L. S.

TOOL AND CUTTER-GRINDER ATTACHMENTS
Cincinnati Milling Machine Co.
Mummert-Dixon Co.
Stanley Electric Tools

TOOL BITS
Atlas Press Co.
Williams & Co., J. H.

TOOL CHARTS
Stanley Tools

TOOL GRINDERS, ELECTRIC
Atlas Press Co.
Delta Mfg. Co.
Dumore Company, The
Millers Falls Co.
Mummert-Dixon Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Walker-Turner Co., Inc.

TOOL GRINDERS, OILSTONE
Oliver Machinery Co.
Mummert-Dixon Co
Wallace Co., J. D.

TOOL ROOM GRINDERS
Boyar-Schultz Corp.

TOOL HOLDERS
Armstrong Bros. Tool Co.
Atlas Press Co.
South Bend Lathe Works
Williams & Co., J. H.

TOOL POST GRINDERS
Atlas Press Co.
Chicago Wheel & Mfg. Co.
Dremel Mfg. Co.
South Bend Lathe Works
Stanley Electric Tools

TRACING PAPER AND CLOTH
Dietzgen Co., Eugene
Post Company, Frederick
U. S. Blue Print Paper Co.
Weber Company. F.

TRANSFORMERS
General Electric Co.

TRIANGLES
Dietzgen Co., Eugene
Engineering Sales Company
Post Company, Frederick
U. S. Blue Print Paper Co.
V. & E. Mfg. Company
Weber Company, F.

TROWELS, PLASTERING, CEMENT, POINTING
Disston & Sons, Inc., Henry
Stanley Tools

TYPE FOUNDERS
American Type Founders Sales Corp.

TYPE GAUGES
American Type Founders Sales Corp.
Rouse Co., H. B

U

UNIVERSAL SAW BENCHES
Oliver Machinery Co.
Yates-American Machine Co.

UPHOLSTERY SUPPLIES
Upholstery Supply Co.

V

VALVE GRINDING COMPOUND
Snap-On Tools, Inc.

VALVE GRINDING EQUIP.
Black & Decker Mfg. Co.
Snap-On Tools Inc.

VARIETY SAW BENCHES
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

VENEER
Brodhead-Garrett Co.
Craftsman Wood Service Co.
Giles & Kendall
Tegge Lumber Co.

VISES, BENCH
Atkins & Co., E. C.
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Desmond-Stephan Mfg. Co.
Millers Falls Co.
Morgan Vise Co.
Snap-On Tools, Inc.

VISES, BLACKSMITHS'
Atlas Press Co.
Columbian Vise & Mfg. Co.
Desmond-Stephan Mfg. Co.

VISES, MACHINE
Armstrong Bros. Tool Co.
Atlas Press Co.
Cincinnati Milling Machine Co.
Desmond-Stephan Mfg. Co.
North Brothers Mfg. Co.

VISES, METALWORKING
Columbian Vise & Mfg. Co.
Desmond-Stephan Mfg. Co.
Morgan Vise Co.

VISES, PIPE
Armstrong Bros. Tool Co.
Atlas Press Co.
Columbian Vise & Mfg. Co.
Desmond-Stephan Mfg. Co.
Morgan Vise Co
Williams & Co., J. H

VISES, WOODWORKERS'
Atlas Press Co.
Boice Crane Company
Cincinnati Tool Co.
Desmond-Stephan Mfg. Co.
Columbian Vise & Mfg. Co.
Morgan Vise Co.

VOLTMETERS
General Electric Co.
Weston Electric Instrument Co.

W

WATTMETERS
General Electric Co.
Weston Electric Instrument Co.

WEAVING MATERIALS
Hammett Co., J. L.

WELDING EQUIPMENT, ELECTRIC
Delta Mfg. Co.
General Electric Co.
Marquette Mfg. Co.

WELDING TORCHES
American Gas Furnace Mfg. Co.

WOOD FINISHING MATERIALS
Craftsman Wood Service Co.
General Finishes Sales & Service Co.

WOODS
Craftsman Wood Service Co.
Tegge Lumber Company

WOOD TRIMMER
Oliver Machinery Co.

WOOD-TURNING LATHES
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

WOODWORKING LATHES
Atlas Press Co.
Boice Crane Company
Delta Mfg. Co.
Walker-Turner Co., Inc.

WOODWORKING MACHINES, COMBINATION
Boice Crane Company
Delta Mfg. Co.
De Walt Products Co.
Duro Metal Products Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools

WOODWORKING SHAPERS
Boice Crane Company
Delta Mfg. Co.
Duro Metal Products Co.
Oliver Machinery Co.
Parks Woodworking Mach. Co.
Porter-Cable Machine Co.
Shopmaster, Inc.
Walker-Turner Co., Inc.
Yates-American Machine Co.

WOODWORKING TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Craftsman Wood Service Co.
Dremel Mfg. Co.
Greenlee Tool Co.
Millers Falls Co.
Porter-Cable Machine Co.
Stanley Works
X-Acto Crescent Products Co.
Yates-American Machine Co.

WRENCHES, BOX
Armstrong Bros. Tool Co.
Blackhawk Mfg. Co.
Proto Tools
Snap-On Tools, Inc.
Williams & Co., J. H.

WRENCHES, IGNITION
Armstrong Bros. Tool Co.
Proto Tools
Snap-On Tools, Inc.
Williams & Co., J. H.

WRENCHES, OPEN END
Armstrong Bros. Tool Co.
Crescent Tool Co.
Proto Tools
Snap-On Tools, Inc.
Utica Drop Forge & Tool Corp.
Williams & Co., J. H.

WRENCHES, PIPE
Armstrong Bros. Tool Co.
Proto Tools
Snap-On Tools, Inc.
Williams & Co., J. H.

WRENCHES, SOCKET
Armstrong Bros. Tool Co.
Cincinnati Tool Co.
Proto Tools
Starrett Co., L. S.
Snap-On Tools, Inc.
Williams & Co., J. H.

WRENCHES, VALVE TAPPET
Armstrong Bros. Tool Co.
Blackhawk Mfg. Co.
Cincinnati Tool Co.
Proto Tools
Snap-On Tools, Inc
Williams & Co., J. H.

Attention! PLASTIC CRAFT INSTRUCTORS
We Have Large Supply

Screw Driver Handle Stock

FOR TEACHING STUDENTS HOW TO MAKE PLASTIC TOOL HANDLES

Ideal for Screw Drivers — Hammers — Malletheads Chisels — Hatchets — Trowels — Hand Drills, etc.

Round and fluted types. Made of tough, durable Tenite No. 2, ranging in sizes from ¾" to 1½". Makes perfect handles for many different kinds of tools, (see list above) in addition to screw drivers. Available in random colors of red, blue, green, brown, amber and white. Fluted type mostly amber in color, and your choice of four, six, and eight flutes. Immediate shipment. Write for school discounts today!

POLYPLASTEX

(Fibre Glass Locked in Modern Plastics)

A New Art Form Combining Texture and Color for Beauty and Utility

Make Your Own:

- Lamp Shades
- Direct and Indirect Lighting
- Display Material
- Decorative Screens
- Wall Panelling
- Place Mats
- Decorative Accessories

POLYPLASTEX is an artistic skillful fusion of modern plastics and fibre glass. It is a new, original material which, in the fabulous beauty of its unique texture and wide, brilliant color range, is matched only by the breadth and scope of its highly functional adaptability. It's interesting to work with. May be sawed, cut by hand, punched, die-cut, sewn or glued; pleated, fluted, or corrugated; dyed, silk screened, hand painted or embossed. May be washed with soap and water, or brushed. It will not shrink, warp, or sag. We stock a special adhesive for easy cementing of this material.

Write for free sample, or enclose 30¢ for beautiful folder with complete data and eight color samples showing different weaves and formations.

Write for FREE plastics price list, Jewelry Findings Catalog, Information on Fabrication of Plastics — your buying guides for all plastic craft needs.

PLASTIC PARTS & SALES
1157 S. Kingshighway Blvd. St. Louis 10, Mo.

EDUCATIONAL
LAMP PROJECTS

Of particular interest to instructors — in woodworking, general shop, plastics, crafts, electricity, and many other shop courses. Students can design and make the body of the lamp. We supply all other parts necessary — sockets, cords, plugs, shades, harps, switches, etc. Over 700 different parts shown in wholesale catalog. A MUST for all instructors interested in keeping students occupied with highly educational and useful projects. Send today for wholesale price list and parts catalog.

THE GEARON COMPANY
Dept. 100-K3 • 27 S. Desplaines St. • Chicago 6, Ill.

FREE

THIS BIG ILLUSTRATED
LEATHERCRAFT
CATALOG AND GUIDE

LARSON LEATHERCRAFT FOR CRAFTS CLASSES

Complete Stock — Prompt Shipment

Leathercraft is our only business, and our stock is the largest and most complete in America. That is why you can always depend upon immediate and complete shipment of orders sent to us. Whether your requirements are for beginners' kits requiring no tools or experience, for very young boys and girls, or tooling leathers, supplies and tools for older, more advanced students or hobbyists, be sure to check the LARSON LEATHERCRAFT CATALOG first. Write today for your FREE copy of our big new illustrated Catalog and Guide to latest Leathercraft projects.

J. C. LARSON COMPANY
The Foremost Name in Leathercraft
820 S. Tripp Ave., Dept. 1421, Chicago 24, Ill.

J. C. LARSON CO., DEPT. 1421
820 S. Tripp Ave., Chicago 24, Ill.

Please send me a FREE copy of your latest Illustrated Catalog and Guide to Leathercraft.

NAME.....

ADDRESS.....

CITY.....STATE.....

Absolute **ROCK BOTTOM** Prices on...

Practice Scrap PLASTICS

FOR THE SCHOOL SHOP

Ideal for Internal Carving and other classroom projects in plastics.

Miscellaneous Assortment

LOT No. 1 Includes small odd shapes, strips, cut-offs. Pieces range in size from one square inch per piece up to 36 square inches per piece. 1/16" through 1" in thickness. 90% clear and carvable.
3 Lbs. $1.00

Triangle Assortment

LOT No. 2 All 7/8" and 1" clear Lucite and Plexiglas. Two sides measure approximately 7" to 8" in length. Long diagonal side concave. Affords ideal working thickness for the beginner in internal carving. All paper masked, carvable.
Per Lb. .....$ .75
10 Lbs. 6.00
25 Lbs. 12.50

HANDEE CARVING DRILLS
1/16", 3/32", 1/8".....**$1.25 ea.**

Square and Rectangular Block Assortment

LOT No. 3 7/8" and 1" Plexiglas and Lucite. In strips and squares. None smaller than 1½" square. None over 2¾" square. Strips, maximum length, 12". Practically no chance of waste with this material.
Per Lb. $1.00
10 Lbs. 9.00

NEW SPECIAL FOREDOM FLEXIBLE SHAFT MACHINES. No. W-50-LR. Powered with a Westinghouse high-speed motor. Comes equipped with No. 5 hand piece. 35" rubber sheathed cable. A professional tool.
For Limited Time Only...$21.95
F.O.B. St. Louis, Mo.

FOREDOM CARVING DRILLS
1/16" and 3/32".....**$ .80 ea.**
1/8" ..... **1.00 ea.**

Don't pass up this chance to make real worthwhile savings on plastics. Material offered subject to prior sale, and subject to our selection. All prices F.O.B. St. Louis, Mo.

ALL MATERIAL GUARANTEED FIRST CLASS CONDITION!

Some colored scrap available. Write for prices.

D. W. COPE PLASTICS
9833 Highway 99 • Dept. R • St. Louis 21, Mo.

Index to Advertisers' Products and Services

Advertisers in this index are given a key number in addition to the page number on which the advertisement appears. Refer to the advertisement for product or services available. Write direct to advertiser or use the business reply card in requesting information from a number of advertisers.

Code No.		Page No.
30	**Adjustable Clamp Company** *Clamps, Handscrew, Bar, "C," etc.*	90A
31	**Allied Radio Corp., The** *Radio Parts, Radio Sound Equipment*	85A
32	**Alvin Company** *Drafting Instruments & Supplies*	98A
33	**American Gas Furnace** *Heat-Treating Equipment*	96A
34	**American Lead Pencil Co., Inc.** *Pencils*	90A
35	**American Technical Society** *Publishers*	74A
36	**American Type Founders, Inc.** *Printshop Equipment & Supplies*	65A
37	**Ames Precision Machine Works** *Metalworking Hardness Testers*	77A
38	**Architectural Model Materials, Inc.** *Model Buildings*	98A
39	**Armstrong Bros. Tool Co.** *Metalworking Tools & Tool Holders*	62A
310	**Atkins and Company, E. C.** *Saws*	36A
311	**Atlas Press Company, The** *Woodworking & Metalworking Machine Tools*	15A
312	**Badger-American Electrotype Co.** *Electrotype Service*	98A
313	**Bennett Co., Inc., Chas. A.** *Publishers*	82A
314	**Bergling, V. C.** *Publishers*	96A
315	**Berkray Products, Inc.** *Sheet Metal Equipment*	63A
316	**B. & I. Manufacturing Co.** *Project Material*	92A
317	**Black and Decker Mfg. Co.** *Portable Electric Tools*	5A
318	**Blackhawk Mfg. Company** *Automotive Equipment*	49A
319	**Board of Examiners**	98A
320	**Boice-Crane Company** *Woodworking Machine Tools*	96A
321	**Boyar-Schultz Corp.** *Machine Tools*	16A
322	**Bradley University**	89A
323	**Brodhead-Garrett Company** *Shop Equipment & Supplies*	8A
324	**Brooks Co., Inc., R. D.** *New & Used Shop Equipment*	98A
325	**Bruce Publishing Company** *Publishers*	3rd cover
326	**Buss Machine Works** *Woodworking Machine Tools*	80A
327	**Cadillac Plastic Co.** *Plastics*	39A
328	**Camp Mah-Kee-Nac** *Camp for Boys*	98A
329	**Chicago Wheel and Mfg. Co.** *"Handee" Tools*	88A
330	**Cincinnati Lathe & Tool Company, The** *Lathes*	31A
331	**Cincinnati Milling Machine Co.** *Metalworking Machine Tools*	19A & 51A
332	**Cincinnati Tool Company, The** *Clamps, Carriage & Screw; Chisels; Punches*	56A
333	**Colorado A & M College**	89A
334	**Columban Vise & Mfg. Co.** *Vises for Metal & Wood, Bench Screws*	20A
335	**Connolly, J. J.** *Leather Headquarters*	98A
336	**Cope-Plastics, D. W.** *Plastics & Related Supplies*	100A
337	**Crafters of Pine Dunes** *Project Material*	94A
338	**Craftsman Supply House** *Project Material*	94A
339	**Craftsman Wood Service Co.** *Woods & Handicraft Supplies*	85A
340	**Crescent Tool Co.** *Machine Tools & Equipment*	14A
341	**Crown Leather Co.** *Leathercraft*	96A
342	**Cunningham Co., M. E.** *Safety Steel Stamps*	76A
343	**Curtis Pneumatic Mach Div., Curtis Mfg. Co.** *Automotive Tools & Supplies*	43A
344	**Delmar Publishers** *Publishers*	88A
345	**Delta-Rockwell Power Tool Div.** *Woodworking Machine Tools & Metalworking*	9A
346	**Designers Company** *Project Materials*	94A
347	**Desmond-Stephan Mfg. Co.** *Vises*	4A
348	**De Walt Products Corp.** *Woodworking Machine Tools*	33A
349	**Dick Company, A. B.** *Mimeographs & Mimeograph Equipment*	74A
350	**Dietzgen Company, Eugene** *Drafting Instruments & Supplies*	2nd cover
351	**DoAll Company, The** *Machine Tools*	79A
352	**DonJer Products** *Project Material*	96A
353	**Dremel Mfg. Co.** *Electric Grinders & Sanders*	62A
354	**Driscoll & Co., Martin** *Printing Inks*	94A
355	**Dumore Company, The** *Grinding Tools*	28A
356	**Dumville, S. H.** *Electronics Educator*	98A
357	**Duro Metal Products Co.** *Woodworking Machine Tools*	32A
358	**Eagle Pencil Company** *Pencils*	68A
359	**Eastman Kodak Co.** *Films, Projectors*	27A
360	**Elbar Products** *Carving Drills for Plastics*	98A
361	**Empire Tackle Company** *Fishing Tackle Projects*	96A
362	**Engineering Manufacturing Co.** *Drafting Room Equipment*	72A
363	**Foley Lumber Company, T. A.** *Lumber*	82A
364	**Foley Manufacturing Co.** *Saw Filing Equipment*	46A
365	**Ford Motor Company** *Buses*	28A
366	**Foredom Electric Co.** *Flexible Shaft Machines*	82A
367	**Franklin Glue Company** *Glue*	59A
368	**Gearon Company, The** *Project Material*	100A
369	**General Electric Company** *Electrical Equipment*	52A
370	**General Finishes Sales & Serv. Co.** *Wood Finishes*	90A
371	**Gilbert & Miller** *Pens, Fountain, Desk*	70A & 94A
372	**Giles and Kendall Co.** *Project Material*	96A
373	**Greenlee Tool Co.** *Hand Tools*	57A
374	**Gyro Lamp and Shade Corp.** *Lamp Parts*	94A
375	**Hamilton Manufacturing Co.** *Manual Training Equipment & Supplies*	60A
376	**Hammett Company, J. L.** *Looms — Handicraft Supplies*	96A
377	**Hardwood Corp. of America** *Lumber, Hardwood*	83A
378	**Harper Electric Furnace Corp.** *Ceramic Kilns, Electric*	78A
379	**Higgins Ink Co., Inc.** *Drawing Inks*	69A

INDEX CONTINUED ON NEXT PAGE

USE THIS CARD

This postage paid card is provided for the convenience of directors, supervisors, and shop instructors in requesting information on products, services, booklets, and catalogs offered by the advertisers in this issue.. See reverse side.

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 1112, Sec. 34.9 P. L. & R., Milwaukee 1, Wis.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

P.O. Box 2068

MILWAUKEE 1, WISCONSIN

Index to Advertisers—continued

Code No.		Page No.
380	Hubbell Metals, Inc. *Metals for Handicraft*	96A
381	Hunt Pen Co., Inc., C. Howard *Pens*	81A
382	Indianhead Archery & Mfg. Co. *Project Material*	98A
383	International Textbook Co. *Publishers*	84A
384	Johnson Gas Appliance Co. *Heat-Treating Furnaces*	79A
385	Kalamazoo Tank & Silo Co. *Metal Cutting Band Saws*	35A
386	Kearney & Trecker Corp. *Milling Machines*	17A
387	Kester Solder Company *Flux & Solders*	6A
388	Larson Co., J. C. *Project Material*	100A
389	Leather Products Co. *Leather Project Material*	94A
390	Le Blond Machine Tool Co., R. K. *Metalworking Machine Tools*	4th cover
391	Lima Electric Motor Co. *Gear Shift Drive & Motors*	47A
392	Lipe-Rollway Corporation *Hack Saws, Blades, Metal Cutting Saws*	48A
393	Logan Enginering Company *Metalworking Machine Tools*	21A
394	Lufkin Rule Company, The *Precision Measuring Tools*	71A
395	Macmillan Company, The *Publishers*	75A
397	McGraw-Hill Book Co., Inc. *Publishers*	84A
398	McKnight and McKnight *Publishers*	81A & 83A
399	Misener Mfg. Company *Hack Saws*	94A
3100	Metal Crafts Supply Co. *Project Material*	94A
3101	Millers Falls Company *Hand & Power Tools for Wood & Metal*	13A
3102	Milwaukee School of Engineering	87A
3103	Morgan Vise Company *Vises for Metal & Wood*	18A
3104	Mummert-Dixon Company *Grinders*	98A
3105	Murphy's Sons Co., Robert *Knives, Manual Training Tools & Supplies*	85A
3106	National Forge-Ordnance Co. *Electrical Testing Equipment*	80A
3107	New York University	89A
3108	Nicholson File Company *Files and Rasps*	2A
3109	North Brothers Mfg. Co. *Hand Tools for Woodworking*	76A
3110	Ohmite Manufacturing Co. *Radio Parts, Electrical Equipment*	72A
2111	Oliver Machinery Co. *Woodworking Machinery, Metal Spinning Lathes*	23A
3112	O'Neil-Irwin Mfg. Company *Sheet Metal Equipment*	35A
3113	Oregon State College	87A
3114	Osborn Bros. *Project Material*	96A
3115	Parks Woodworking Machine Co. *Woodworking Machine Tools*	56A
3116	Paxton Lumber Co., Frank *Lumber & Plywood*	61A
3117	Pennsylvania State College	89A
3118	Pittsburgh Plate Glass Co. *Woodfinishing Material*	67A
3119	Plastic Parts & Sales *Project Material*	100A
3120	Plastic Supply Company *Project Material*	94A
3121	Plumb, Inc., Fayette R. *Hammers*	92A
3122	Porter-Cable Machine Co. *Woodworking Machine Tools*	36A
3123	Post Company, Frederick *Drafting Instruments and Supplies*	73A
3124	Pratt Company, G. A. *Bookbinders' Supplies*	94A
3125	Preto Tools *Hand Service Tools for All Industries*	78A
3126	P.T.I., Incorporated *Circular Saw Blades*	46A
3127	Racine Tool & Machine Co. *Metal Cutting Saws*	34A
3128	Red Devil Tools *Glazing Tools*	96A
3129	Rider, Publisher, Inc., John F. *Publishers*	61A
3130	Rockford Machine Tool Co. *Metalworking Machine Tools*	12A
3131	Rouse & Co., H. B. *Printshop Equipment*	44A
3132	Ruby Chemical Company *Solders*	82A
3133	Russo Handicraft Supplies *Project Material*	96A
3134	Sax Bros., Inc. *Leather, Tools & Supplies*	94A
3135	Seeley's Ceramic Studio *Ceramics*	94A
3136	Sheldon Machine Co., Inc. *Metalworking Machine Tools*	26A
3137	Shopmaster, Inc. *Sanders, Lathes, Saws*	25A
3138	Shopsmith *Woodworking Machine Tools*	7A
3139	Sjostrom Co., John E. *Vocational Furniture*	56A
3140	Snap-On Tools, Inc. *Automotive Tools*	41A
3141	South Bend Lathe Works, *Metalworking Machine Tools*	1A
3142	Stanley Tools *Hand & Power Tools for Wood & Metal*	79A
3143	Stanley Electric Tool Div. *Portable Electric Tools*	42A
3144	Starrett Co., The L. S. *Precision Measuring Instruments*	37A
3145	Sta-Warm Electric Company *Glue Pots*	96A
3146	Sterling Wheelbarrow Co. *Foundry Equipment*	77A
3147	Sunbeam Corporation *Heat-Treating Furnaces*	35A
3148	Syncro Corporation *Jig Saws*	55A
3149	Tandy Leather Company *Leathercraft Supplies*	92A
3150	Tegge Lumber Company *Lumber & Plywood*	77A
3151	United States Blue Print Paper Company *Drafting Material*	66A
3152	University of Minnesota	87A
3153	University of Southern California	87A
3154	Upholstery Supply Co., The *Upholstery Supplies*	92A
3155	Utica Drop Forge & Tool Corp. *Automotive Tools*	22A
3156	V. and E. Mfg. Company *Drafting Instruments & Supplies*	66A
3157	Van Nostrand Company, D. *Publishers*	83A
3158	Walker-Turner Division *Woodworking & Metalworking Machine Tools*	10A & 11A
3159	Wallace Company, J. D. *Woodworking Machine Tools*	58A
3160	Weber Company, F. *Drafting Instruments & Supplies*	81A
3161	Weldon Laboratory, James W. *Ceramics — Kilns & Supplies*	94A
3162	Weller Mfg. Co. *Electric Soldering Irons*	38A
3163	Western States Envelope Co. *Envelopes*	85A
3164	Weston Electrical Instrument Co. *Electrical Measuring Instruments*	53A
3165	Willson Products, Inc. *Safety Goggles*	29A
3166	X-Acto Crescent Products Co., Inc. *Project Material*	88A
3167	Yates-American Machine Co. *Woodworking Machine Tools*	24A

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION March, 1952
400 North Broadway, Milwaukee 1, Wis.

Please ask the advertiser, indicated by the key number encircled, to send information offered in the advertisement.

30	311	322	333	344	355	366	377	388	399	3110	3121	3132	3143	3154	3165
31	312	323	334	345	356	367	378	389	3100	3111	3122	3133	3144	3155	3166
32	313	324	335	346	357	368	379	390	3101	3112	3123	3134	3145	3156	3167
33	314	325	336	347	358	369	380	391	3102	3113	3124	3135	3146	3157	
34	315	326	337	348	359	370	381	392	3103	3114	3125	3136	3147	3158	
35	316	327	338	349	360	371	382	393	3104	3115	3126	3137	3148	3159	
36	317	328	339	350	361	372	383	394	3105	3116	3127	3138	3149	3160	
37	318	329	340	351	362	373	384	395	3106	3117	3128	3139	3150	3161	
38	319	330	341	352	363	374	385	396	3107	3118	3129	3140	3151	3162	
39	320	331	342	353	364	375	386	397	3108	3119	3130	3141	3152	3163	
310	321	332	343	354	365	376	387	398	3109	3129	3131	3142	3153	3164	

Also information on _____

Name _____ Position _____

School _____

Address _____

City _____ Zone _____ State _____

USE THIS CARD

Encircle the key number of the advertisement in which you are interested.

Where the advertisement states that a charge is made for a catalog or booklet, the amount indicated, cash, check or postage, must accompany your request if you encircle the key number to obtain the material offered, and should be sent directly to the advertiser.

Detach and mail card. No postage required.